

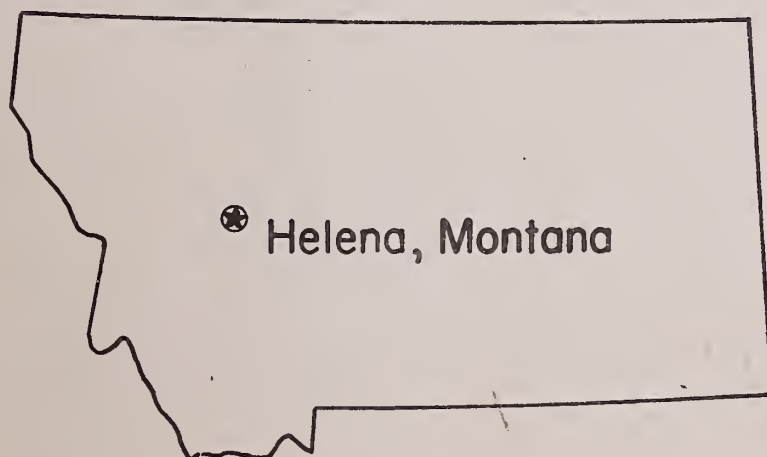
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STANDARD DRAWINGS

SUPPLEMENTAL
TO
STANDARD SPECIFICATIONS
FOR
ROAD AND BRIDGE CONSTRUCTION

STATE OF MONTANA
HIGHWAY COMMISSION



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This Standard Drawing Book, effective January 1, 1969, attempts to show drawings in a manner that conforms to the applicable sections of the Standard Specifications. For your convenience, we are listing drawings whose numbers have changed from those of the book effective May 1, 1963. Those not listed, remain the same.

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STATE HIGHWAY COMMISSION
HELENA, MONTANA 59601

January 15, 1971

STANDARD DRAWING BOOK

We are sending the following additions and/or revisions effective January 15, 1971 to be included in your present Standard Drawing Book, the grey covered one, original issue January 1, 1969.

90-04 - BRIDGE END TREATMENT (STEEL GUARD RAIL - BRIDGE APPROACH PANEL) Revised Effective 1-15-71.

NOTE: 1. Add this drawing to your book.

2. We are also sending you revised index sheets 7 and 8.
The revisions are as follows:

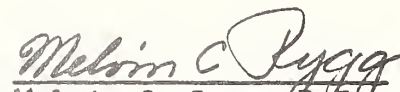
90-04 - Added the words, Steel Guard Rail - Bridge
Approach Section and Revised Effective 1-15-71.

90-08 - Added to index - Reflector-Washer Effective
1-1-71.

90-17 - Deleted as of 1-1-71

90-18 - Deleted as of 1-1-71

3. You should destroy the old index sheets 7 and 8.


Melvin C. Rygg, P.E.,
Office Engineer



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STATE HIGHWAY COMMISSION
HELENA, MONTANA 59601

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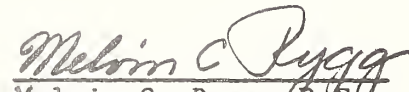
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Melvin C. Rygg, P.E.,
Office Engineer

STATE HIGHWAY COMMISSION
HELENA, MONTANA 59601

STANDARD DRAWINGS FOR HIGHWAY CONSTRUCTION

These Standard Drawings which are supplementary to the Standard Specifications become effective January 1, 1969.

In the future when revised drawings are sent, they will become effective on the date shown thereon and the superseded drawings should be retained until no longer applicable.

New drawings issued will become effective on the date shown thereon.

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Change this Drawing No. to 90-21

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100-12 Garbage Can Rack

100-13 Historical Marker
Added Effective 7-1-69
Revised Effective 1-1-71

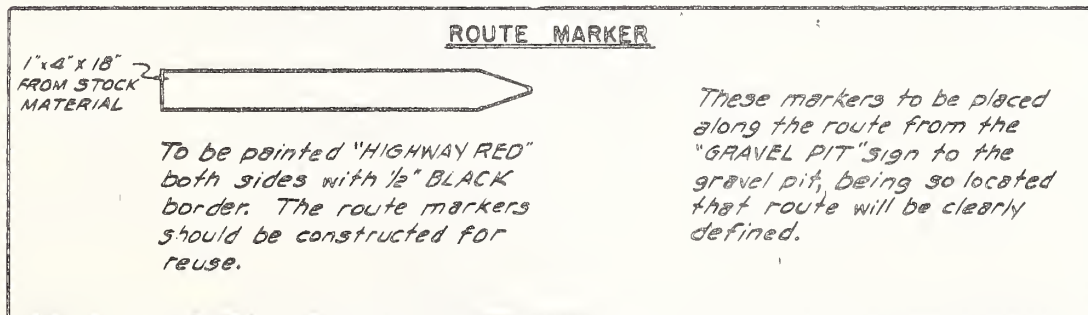
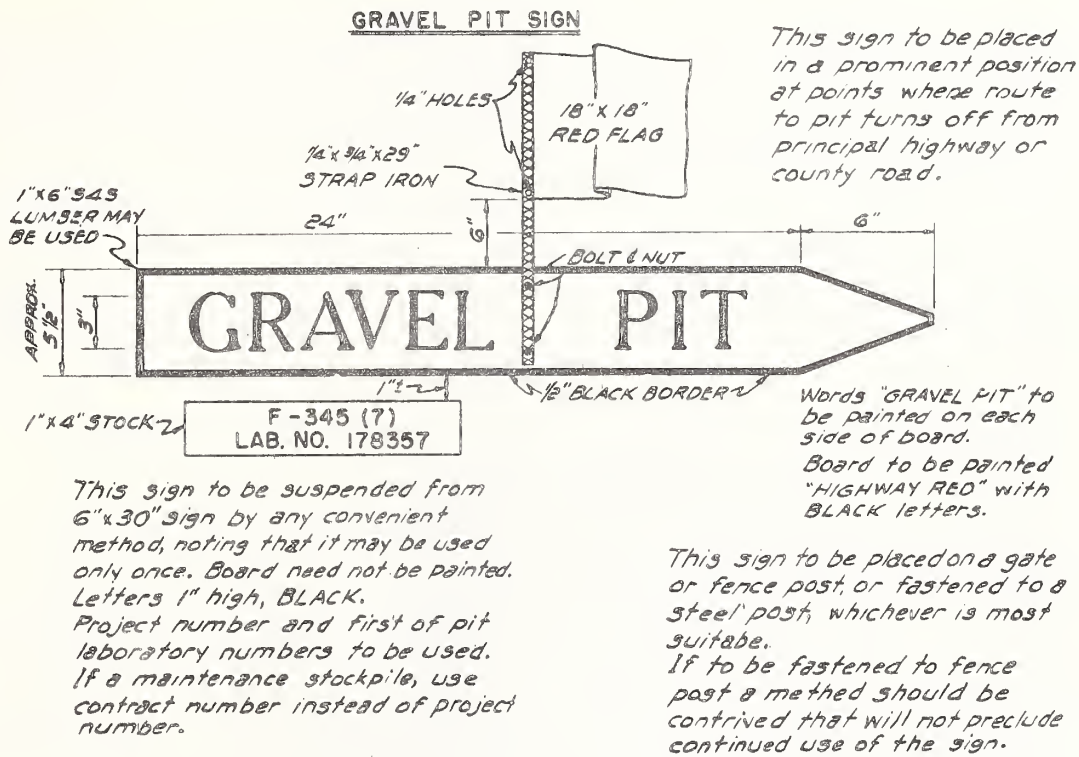
REVISED 5-1-63
EFFECTIVE 5-1-63

STANDARD DRAWING NO. 06-01

State Highway Commission
Helena, Montana

GRAVEL PIT MARKERS

Approved
Levin M. Chittum 10-18-68
State Highway Engineer



MARKINGS AT PIT

The gravel pit should be marked and signed in accord with any current instructions. In general, the boundary of the pit should be well marked by lath and RED flags. Test holes should be marked by stakes - showing depth of overburden and gravel.

These signs furnished and erected by
Montana Highway Department

GUIDE AND GUARD RAIL POSTS

GENERALLY 8"x8" S&S

KNOTS: KNOTS MUST BE SOUND, TIGHT AND WELL SPACED. KNOT CLUSTERS 1 INCH OR LARGER ARE UNACCEPTABLE. KNOTS WITH AN AVERAGE DIAMETER LARGER THAN 2 1/2 INCHES ARE UNACCEPTABLE, EXCEPT THAT KNOTS LYING ENTIRELY BELOW A LINE 2 FEET FROM THE BOTTOM OF THE POST MAY BE UP TO 4 INCH DIAMETER.

SEASONING CHECKS: SEASONING CHECKS WITH AN AVERAGE DEPTH OR TOTAL DEPTH LARGER THAN 1/2 OF THE DIMENSION NEAREST TO PARALLEL TO THE CRACK, ARE UNACCEPTABLE.

SURFACE CHECKS: SURFACE CHECKS WIDER THAN 5/16 INCH ARE UNACCEPTABLE. A SURFACE CHECK THROUGH A BOLT HOLE IS ACCEPTABLE IF NO WIDER THAN 5/16 INCH.

SHAKES: SHAKES THAT ARE LONGER THAN 1/3 THE GREATEST END DIMENSION ARE UNACCEPTABLE.

SPLITS: SPLITS WITH AN AVERAGE WIDTH GREATER THAN 3/16 INCH OR A DEPTH GREATER THAN THE END DIMENSION PERPENDICULAR TO THE SPLIT ARE UNACCEPTABLE. SPLITS ACCEPTED ON THE BOTTOM OF THE POST ONLY.

SLOPE OF GRAIN: POSTS HAVING A SLOPE OF GRAIN GREATER THAN 2 INCHES IN 20 INCHES ARE UNACCEPTABLE.

WANE: THE WIDTH OF WANE SHALL NOT EXCEED 1/4 THE WIDTH OF THE SIDE ON WHICH IT OCCURS.

SIGN POSTS

GENERALLY 2"-4" THICK BY 4" OR MORE

GRADING RULES FOR SIGN POSTS ARE THE SAME AS THOSE FOR GUARD RAIL AND GUIDE POSTS EXCEPT--

KNOTS: KNOTS MUST BE SOUND, TIGHT AND WELL SPACED. KNOT CLUSTERS 1 INCH OR LARGER ARE UNACCEPTABLE. KNOTS ARE ACCEPTABLE IN THE FOLLOWING AVERAGE DIAMETERS:

NARROW FACE
 1 1/2" DIA. - MIDDLE 1/3 OF POST
 2" DIA. - END 1/3 OF POST

WIDE FACE
 1 1/2" DIA. - MIDDLE 1/3 OF POST
 1 1/2" DIA. - EDGES OF POST
 1 1/2" DIA. - ELSEWHERE ON FACES

WANE: NOT PERMITTED

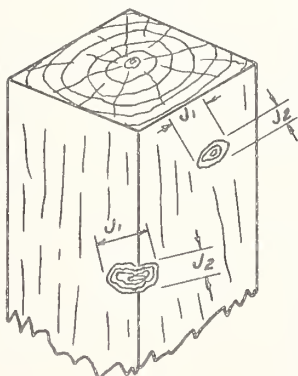
SLOPE OF GRAIN: POSTS HAVING A SLOPE OF GRAIN GREATER THAN 2 INCHES IN 20 INCHES ARE UNACCEPTABLE IN THE MIDDLE 1/3 OF THE POST. THE REMAINING 2/3 OF THE POST MAY HAVE A SLOPE OF GRAIN OF 2 INCHES IN 16 INCHES.

WARP OR BOW: NOT TO EXCEED 1/16 INCH IN EACH FOOT OF POST LENGTH.

SEASONING CHECKS: SEASONING CHECKS WITH AN AVERAGE DEPTH OR TOTAL DEPTH LARGER THAN 1/4 OF THE DIMENSION NEAREST TO PARALLEL TO THE CRACK ARE UNACCEPTABLE.

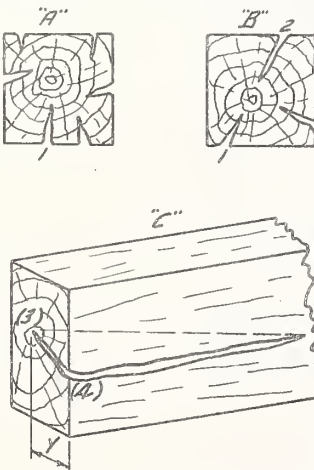
ILLUSTRATION OF TERMS USED IN GRADING TIMBER POSTS

KNOTS



THE AVERAGE DIAMETER OF A KNOT IS $J_1 + J_2 \div 2$

SEASONING CHECKS

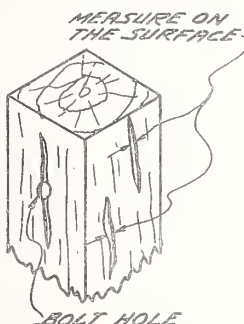


CHECKS ARE MEASURED AS AN AVERAGE OF THE PENETRATION PERPENDICULAR TO THE WIDE FACE. ("A"-1)

WHERE TWO OR MORE CHECKS APPEAR ON THE SAME FACE, ONLY THE DEEPEST ONE IS MEASURED. ("B"-1 & 2)

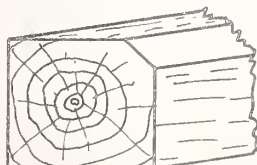
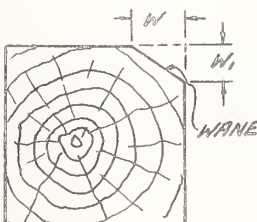
WHERE TWO CHECKS ARE OPPOSITE EACH OTHER IN LINE, USE THE SUM OF THEIR AVERAGE DEPTH. ("C"-AVERAGE DEPTH IS $\frac{1}{2} \sum y$)

SURFACE CHECKS

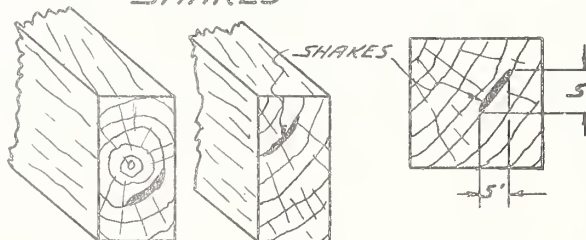


WANE

WANE IS MEASURED ON THE FACE OF THE POST. USE THE LONGEST - W OR W1



SHAKES



A SHAKE IS A SEPARATION OF THE WOOD BETWEEN GROWTH RINGS. MEASURE THE LEAST DIMENSION. (S' OR S)

SLOPE OF GRAIN



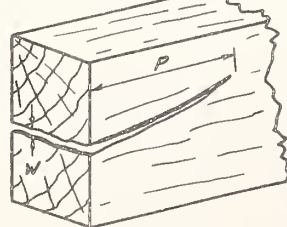
MEASURE "X" & "Y". E.G. IF "X" = 3 WHEN "Y" = 20, POST IS NOT ACCEPTABLE.

WARP OR BOW

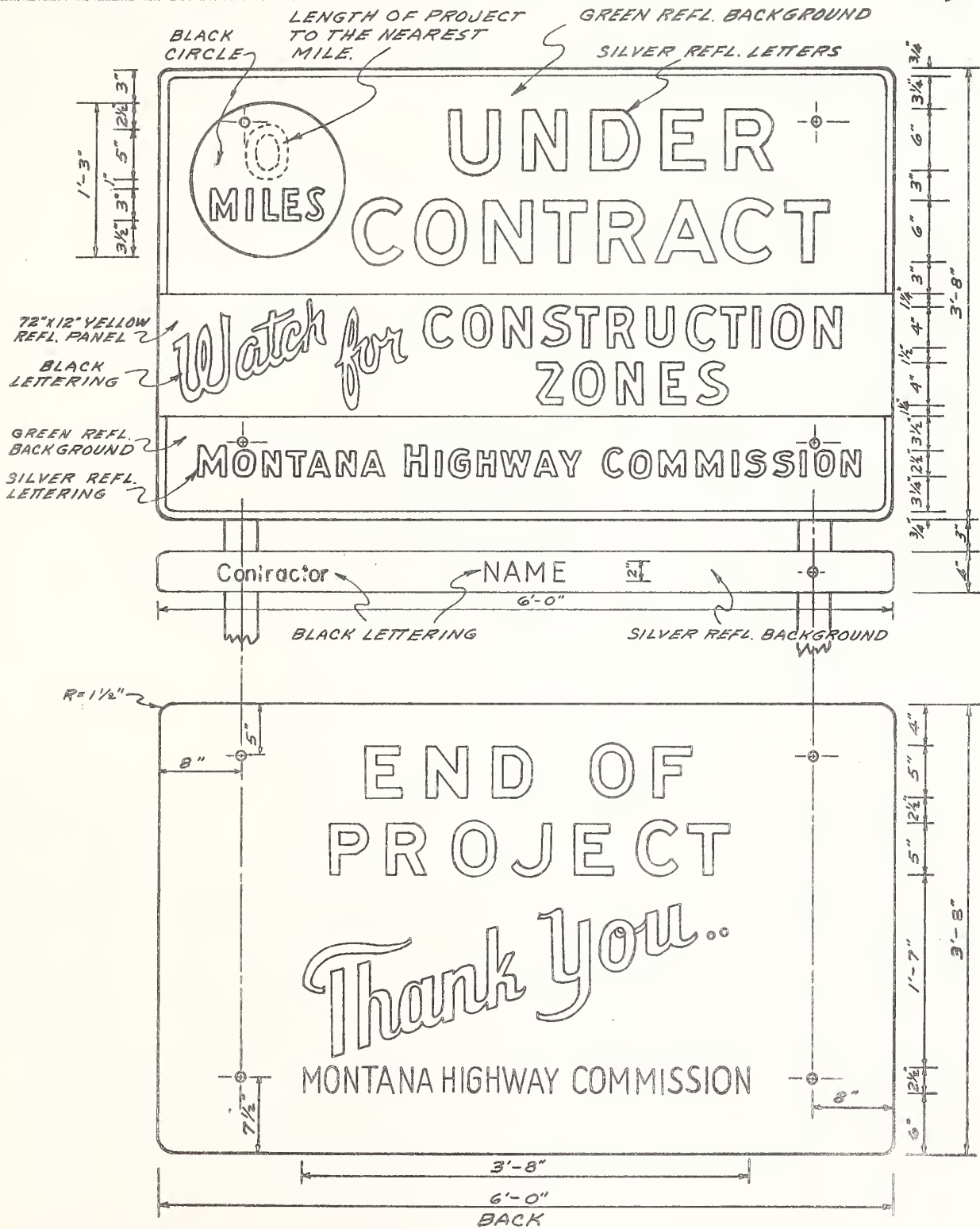
MEASURE WITH A SNAP LINE STRETCHED FROM END TO END OF POST.



SPLITS



SPLITS ARE MEASURED AS THE PENETRATION OF A SPLIT FROM THE END OF A PIECE (P) AND PARALLEL TO THE EDGE.



SIGN CONSTRUCTED OF 1/2" OVERLAID PLYWOOD - 60-60-B-B SIGN GRADE -- EITHER BLACK OR AMBER -- IF BLACK IS USED LETTERING ON BACK OF SIGN SHALL BE WHITE.

ON AMBER BACKGROUND LETTERING IS BLACK.

THIS SIGN WILL BE MADE, FURNISHED, ERECTED AND MAINTAINED BY THE STATE HIGHWAY COMMISSION, UNLESS SPECIFIED OTHERWISE. ONE SIGN WILL BE ERECTED A SHORT DISTANCE AHEAD OF THE BEGINNING, AND THE OTHER A SHORT DISTANCE BEYOND THE END, OF EACH CONSTRUCTION PROJECT. 500 FEET IS THE RECOMMENDED DISTANCE, WHERE PRACTICABLE.

THE SIGN SHOWN ON STANDARD DRAWING NO. 07-03 IS TO BE PLACED A SHORT DISTANCE FROM SIGN CS5R, BETWEEN IT AND THE PROJECT.

State Highway Commission
Helena, Montana

CONSTRUCTION IDENTIFICATION SIGNS - CIS-1 & CIS-2

Approved
State Highway Engineer

CIS-1

12'-0" X 6'-0"

7"	YOUR HIGHWAY TAXES	INTERSTATE MONTANA 00
7"	AT WORK	
4"	FEDERAL HIGHWAY	STATE HIGHWAY FUNDS
4"	TRUST FUNDS	\$000,000
3 1/2"	\$000,000	MONTANA STATE HIGHWAY COMMISSION
3"	U.S. DEPT. OF TRANSPORTATION	
3"	Bureau of Public Roads	

ALL SERIES "C"
LETTERS

USE ON INTERSTATE
PROJECTS ONLY.

SHOULDER
OF ROADWAY

FLAT GROUND OR
ROADWAY INSLOPE

NOTES:-

THE CONSTRUCTION SIGNS SHALL BE FURNISHED, ERECTED AND MAINTAINED BY THE CONTRACTOR. SIGN FACE SHALL BE EXTERIOR GRADE PLYWOOD WITH A SMOOTH AND FLAT FACE, LETTERED AS SHOWN. PLYWOOD SHALL BE OF ADEQUATE THICKNESS TO FORM A FLAT AND RIGID SIGN. SPlicing MAY BE PERMITTED WITH ADEQUATE BACKING. SIGNS TO BE SECURELY MOUNTED ON POSTS OR POLES.

LETTERING WILL BE AS SHOWN, USING B.P.R. STANDARD ALPHABETS (SERIES "C"), AND MAY BE OF DETACHABLE PLATES IF THE CONTRACTOR SO CHOOSES.

THE INTERSTATE SHIELD SHALL HAVE WHITE LEGEND ON INTERSTATE BLUE AND RED BACKGROUND AS INDICATED. THE ABOVE SIGNS SHALL HAVE BLACK LEGEND ON A WHITE NON-REFLECTORIZED BACKGROUND.

SIGNS TO BE INSTALLED WILL BE AS SPECIFIED ON THE PLANS OR IN THE SPECIAL PROVISIONS. THE EXACT LOCATION FOR ERECTION WILL BE DETERMINED BY THE ENGINEER.

CIS-2

8'-0" X 4'-0"

USE
APPROPRIATE
SHIELD



US PRIMARY



MONT. PRIMARY



MONT. SECONDARY

5"	YOUR HIGHWAY TAXES	MONTANA US 00
5"	AT WORK	
2 1/2"	FEDERAL HIGHWAY	STATE HIGHWAY FUNDS
2 1/2"	TRUST FUNDS	\$000,000
2 1/2"	\$000,000	U.S. DEPT. OF TRANSPORTATION
2"	U.S. DEPT. OF TRANSPORTATION	MONTANA STATE HIGHWAY COMMISSION
2"	Bureau of Public Roads	

USE ON PRIMARY,
SECONDARY AND
URBAN PROJECTS.

MOUNTING
HEIGHT ± 5'
ABOVE ROADWAY.

INFORMATION CONCERNING ROUTE NUMBER AND FUNDS DISTRIBUTION WILL BE DETERMINED BY THE ENGINEER. THE CONTRACTOR SHALL NOT ERECT SAID SIGNS UNTIL THE CORRECT LEGEND HAS BEEN DETERMINED. SIGNS SHALL BE ERECTED BEFORE THE START OF WORK.

The rate (per installation) shown on the Construction Sign Rates Schedule of the Special Provisions For Traffic Control, shall be full payment for furnishing, erecting, maintaining and removal of the signs.

REVISED 1-2-63
EFFECTIVE 1-2-63

STANDARD DRAWING NO. 07-08

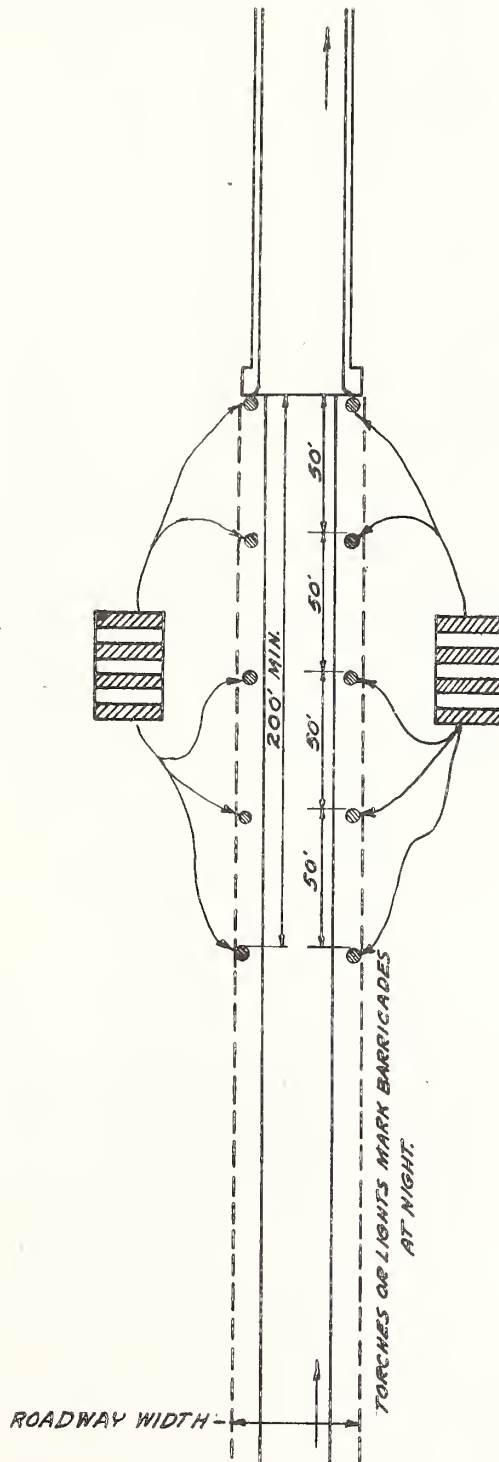
State Highway Commission
Helena, Montana

SIGNING & MARKING BRIDGE ENDS AND OBSTRUCTION

Approved
Lewis H. Chilton 10-24-63
State Highway Engineer

TYPICAL APPLICATION OF DRUM BARRICADES FOR BRIDGE ENDS AND OBSTRUCTION IN OR ADJACENT TO THE ROADWAY

AT LEAST 2 REFLECTORIZED WHITE
BANDS, 6" WIDE, ON ALL DRUM
BARRICADES.



DRUM BARRICADES ARE TO BE USED ON ALL APPROACH
ROADWAYS WHERE THE BRIDGE WIDTH IS 10' (OR MORE)
NARROWER THAN THE APPROACH PAVEMENT. WHEN RE-
QUIRED, DRUM BARRICADES SHALL BE ERECTED BEFORE
TRAFFIC IS ROUTED OVER THE BRIDGE AND SHALL
REMAIN IN PLACE UNTIL THE APPROACH GUARDRAIL
IS INSTALLED.

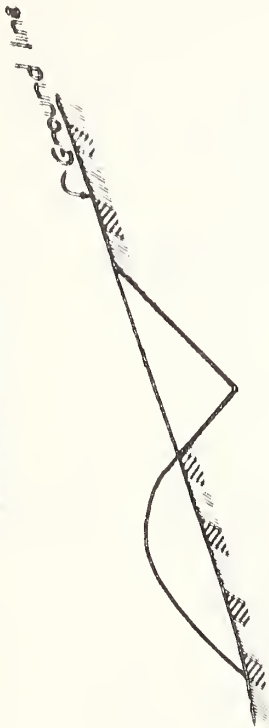
SEE SIGNING MANUAL
FOR DRUM BARRICADE DETAILS

State Highway Commission
Helena, Montana

FURROW DITCH, DITCH BLOCK AND SIGN ISLAND.

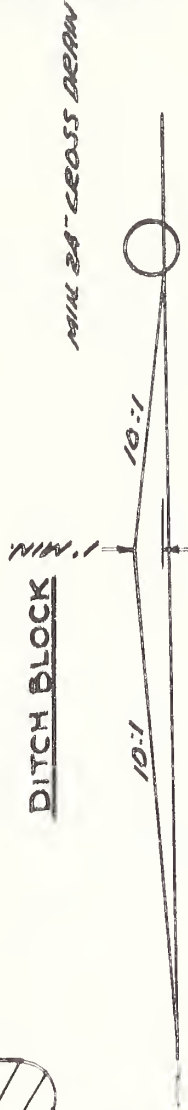
Approved
William J. Phillips
State Highway Engineer

FURROW DITCH



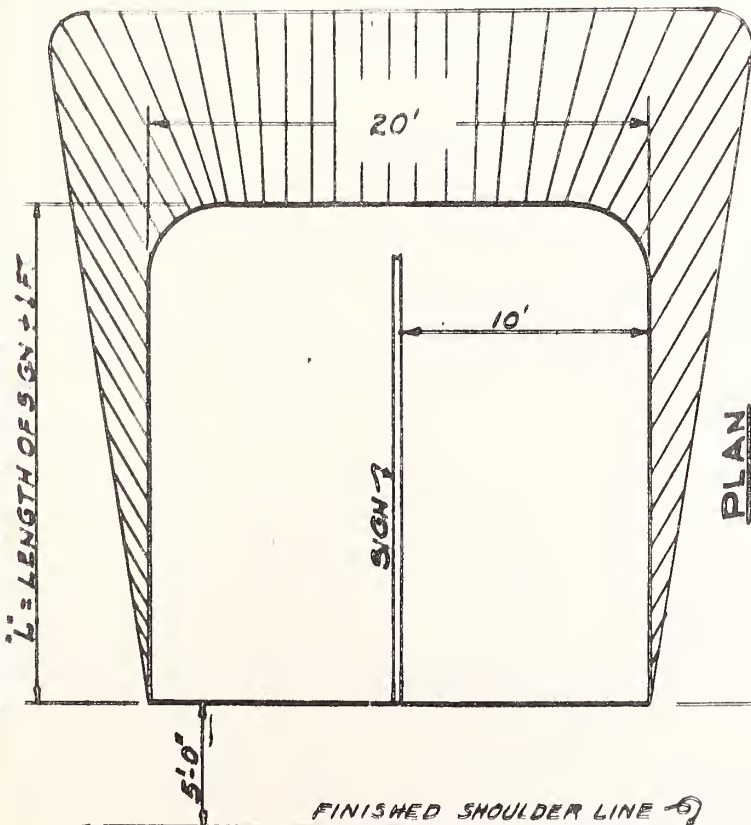
Furrow Ditches shall be constructed wherever and to the depth directed by the Engineer.

DITCH BLOCK



HEIGHT OF DITCH BLOCK WILL VARY DEPENDING ON AMOUNT OF ANTICIPATED DRAINAGE. MINIMUM HEIGHT OF ONE FOOT (1') IS DESIRABLE WITH MAXIMUM HEIGHT OF ONE FOOT (1') BELOW FINISHED ROADWAY SHOULDER ELEVATION ALLOWABLE IF NECESSARY.

DETAIL OF SIGN ISLAND



PLAN

ELEVATION

1. Earthwork for sign island to be compacted to same standard as subgrade.
2. Drainage post sign island to be determined by the Engineer.
3. Sign islands are to be used only where shoulder guard rail is to be provided.

All work shown herein will be paid for as Unclassified Excavation. The unit of measurement is the cubic yard.

REVISED 9-8-67
EFFECTIVE 12-1-67

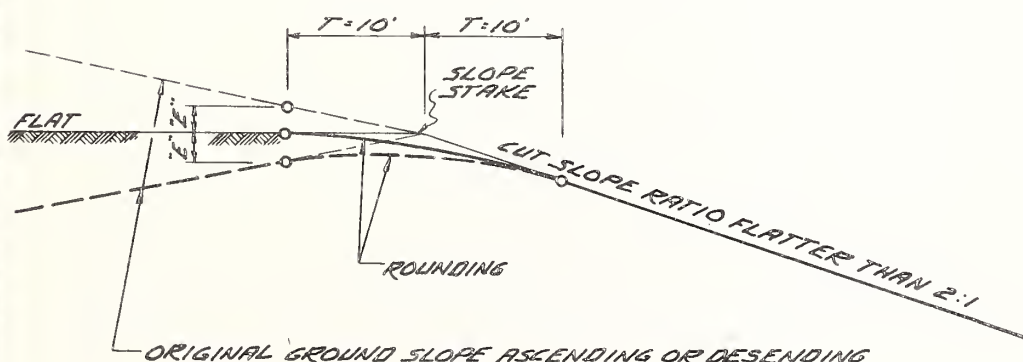
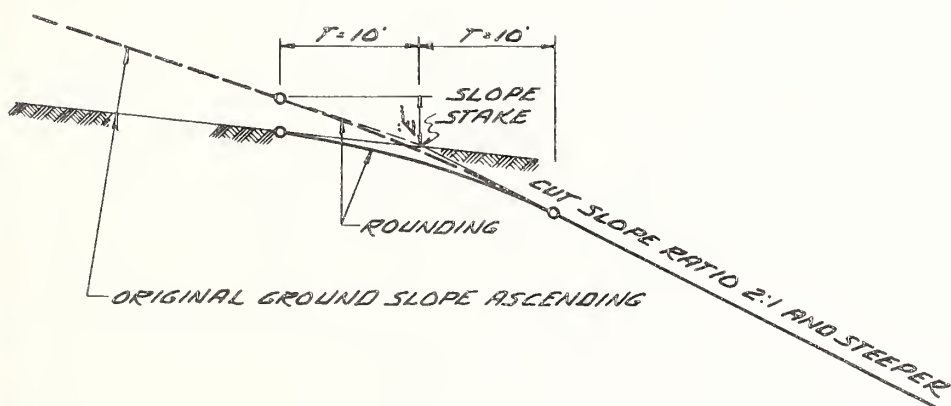
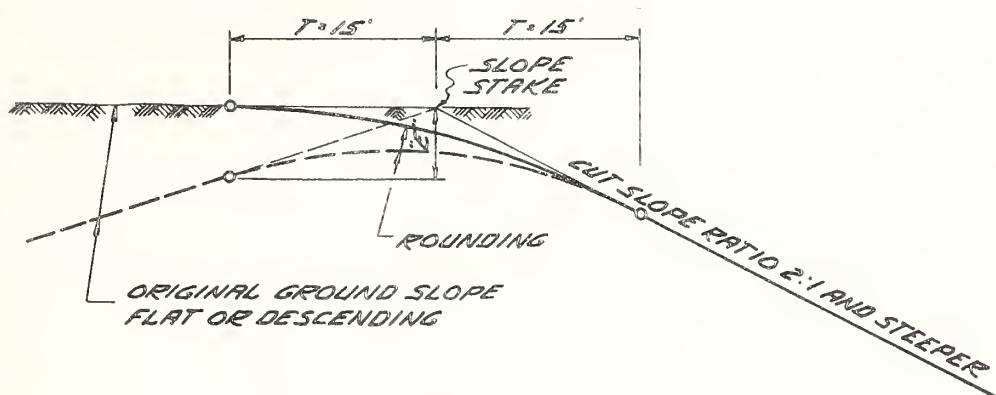
STANDARD DRAWING NO. 11-02

State Highway Commission
Helena, Montana

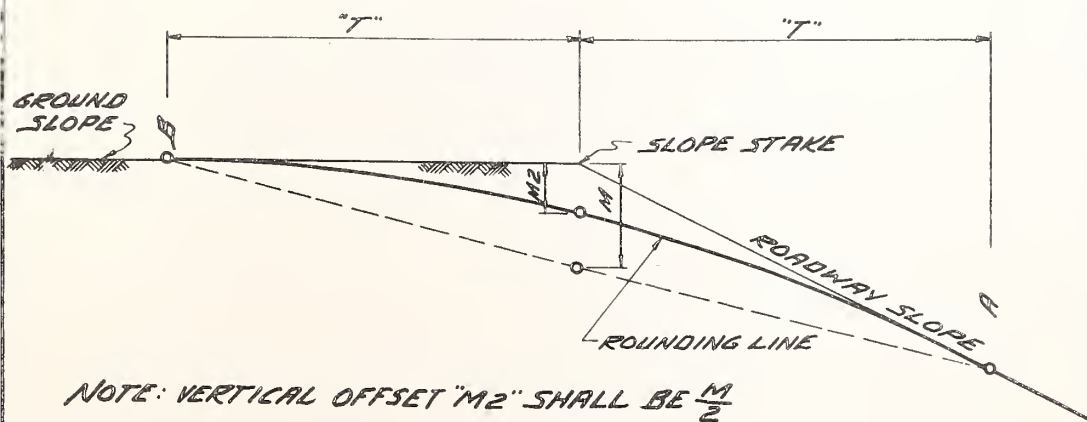
SLOPE ROUNDING

Approved

James M. Phillips
State Highway Engineer



VERTICAL OFFSETS FROM ROADWAY AND GROUND SLOPES
TO ROUNDING LINE FOR CUTS



NOTE: VERTICAL OFFSET "M2" SHALL BE $\frac{M}{2}$

M2-C SLOPES 2:1 & STEEPER (T=15')						
VERT. DIST. "E" (FT.)	DESCENDING GROUND-CUTS					
	M2 = M/2 (FT.)					
	3/4:1	1:1	1 1/2:1	1 3/4:1	2:1	
FLAT	5.0	3.8	3.0	2.5	2.2	1.9
2.0	5.5	4.3	3.5	3.0	2.7	2.4
4.0	6.0	4.8	4.0	3.5	3.2	2.9
6.0	6.5	5.3	4.5	4.0	3.7	3.4
8.0	7.0	5.8	5.0	4.5	4.2	3.9
10.0	7.5	6.3	5.5	5.0	4.7	4.4
12.0	8.0	6.8	6.0	5.5	5.2	4.9
14.0	8.5	7.3	6.5	6.0	5.7	5.4
16.0	9.0	7.8	7.0	6.5	6.2	5.9

M2-C SLOPES 2:1 & STEEPER (T=10')						
VERT. DIST. "E" (FT.)	ASCENDING GROUND-CUTS					
	M2 = M/2 (FT.)					
	3/4:1	1:1	1 1/2:1	1 3/4:1	2:1	
0.1	3.4	2.5	2.0	1.7	1.4	1.3
2.0	2.9	2.0	1.5	1.2	0.9	0.8
4.0	2.4	1.5	1.0	0.7	0.4	0.3
6.0	1.0	1.0	0.5	0.2	0.0	0.0
8.0	1.4	0.5	0.0	0.0		
10.0	0.9	0.0				
12.0	0.4					
14.0	0.0					

M2 FOR CUT SLOPES FLATTER THAN 2:1 (T=10')						
VERT. DIST. "E" (FT.)	DESCENDING GROUND-CUTS					
	M2 = M/2 (FT.)					
	2 1/2:1	3:1	3 1/2:1	4:1	5:1	6:1
FLAT	1.0	0.8	0.7	0.6	0.5	0.4
1.0	1.3	1.1	1.0	0.9	0.8	0.7
2.0	1.5	1.3	1.2	1.1	1.0	0.9
3.0	1.8	1.6	1.5	1.4	1.3	1.2
4.0	2.0	1.8	1.7	1.6	1.5	1.4
5.0	2.3	2.1	2.0	1.9	1.8	1.7
6.0	2.5	2.3	2.2	2.1	2.0	1.9
7.0	2.8	2.6	2.5	2.4	2.3	2.2
8.0	3.0	2.8	2.7	2.6	2.5	2.4
9.0	3.3	3.1	3.0	2.9	2.8	2.7
10.0	3.5	3.3	3.2	3.1	3.0	2.9

M2 FOR CUT SLOPES FLATTER THAN 2:1 (T=10')						
VERT. DIST. "E" (FT.)	ASCENDING GROUND-CUTS					
	M2 = M/2 (FT.)					
	2 1/2:1	3:1	3 1/2:1	4:1	5:1	6:1
FLAT	1.0	0.8	0.7	0.6	0.5	0.4
1.0	0.8	0.6	0.5	0.4	0.3	0.2
2.0	0.5	0.3	0.2	0.1	0.0	0.0
3.0	0.3	0.0	0.0	0.0		
4.0	0.0					
5.0						
6.0						
7.0						
8.0						
9.0						
10.0						

REVISED 11-21-67 10-18-68
EFFECTIVE 12-1-67 1-1-69

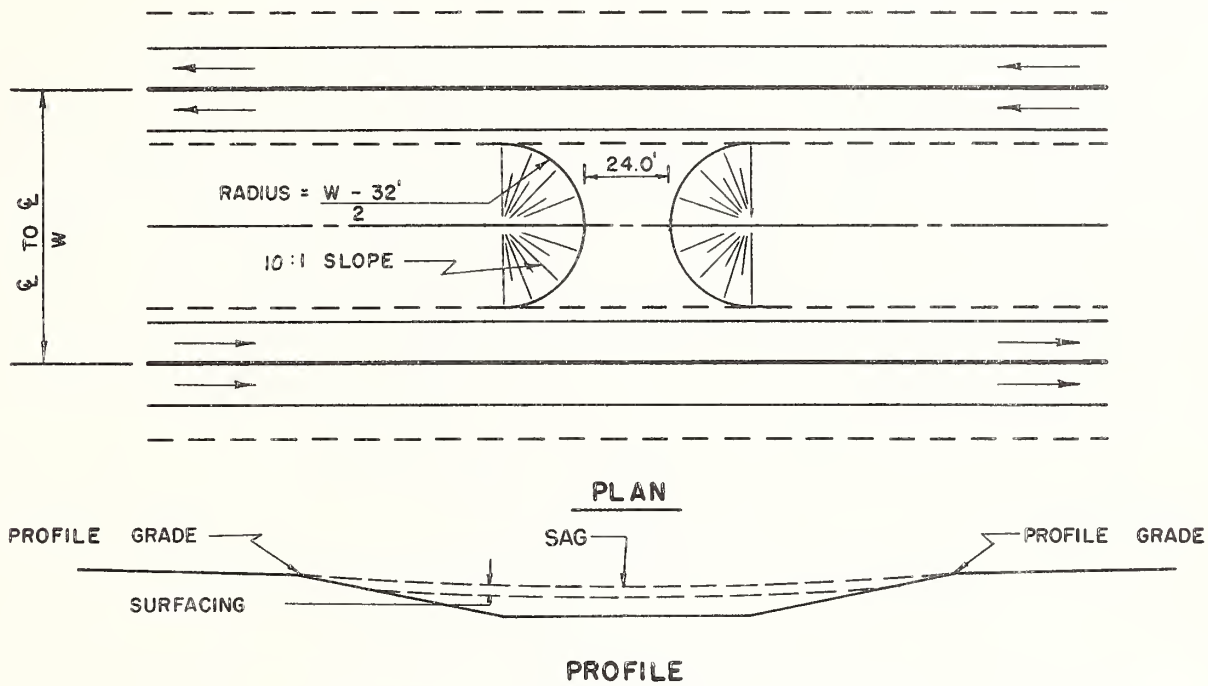
STANDARD DRAWING NO. 11-03

State Highway Commission
Helena, Montana

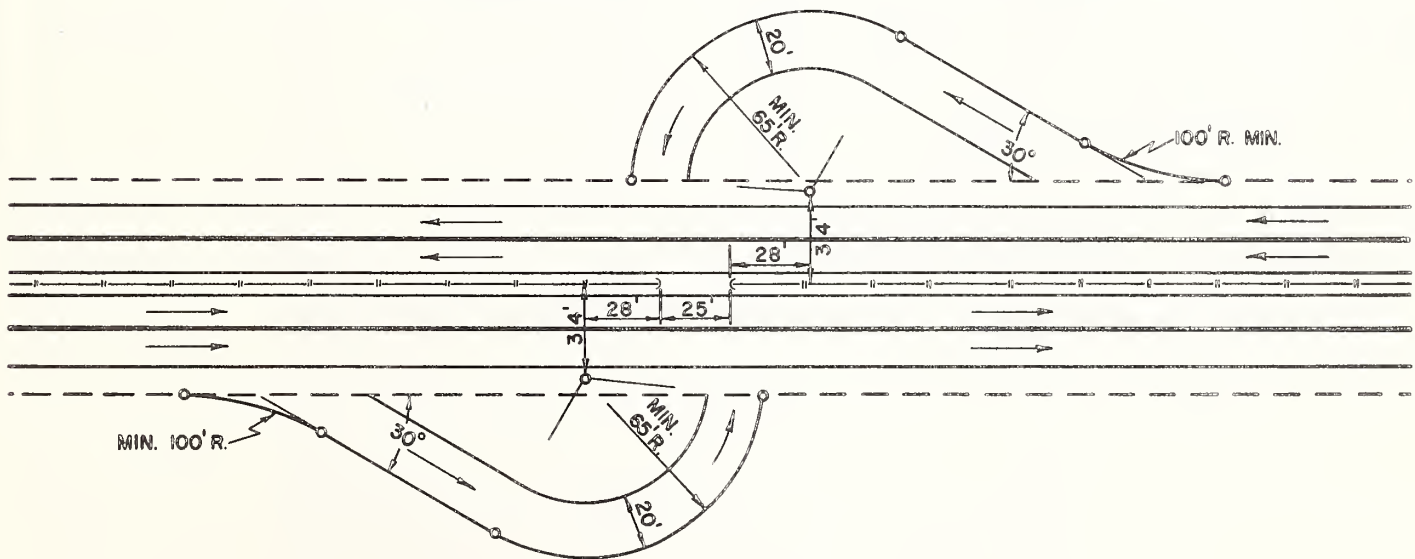
U-TURN MEDIAN OPENINGS ON CONTROLLED ACCESS HIGHWAYS

Approved
Lewis M. Chitties
State Highway Engineer

MEDIAN WIDTHS 36' TO 76'



STANDARD U-TURN FOR NARROW MEDIANS

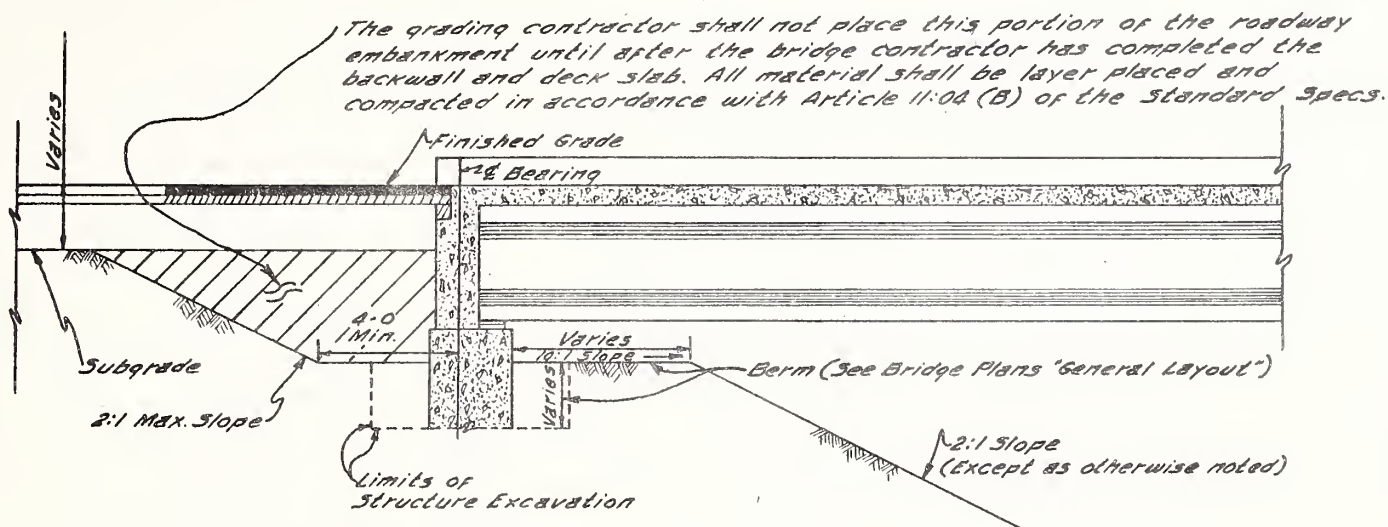


NOTES:

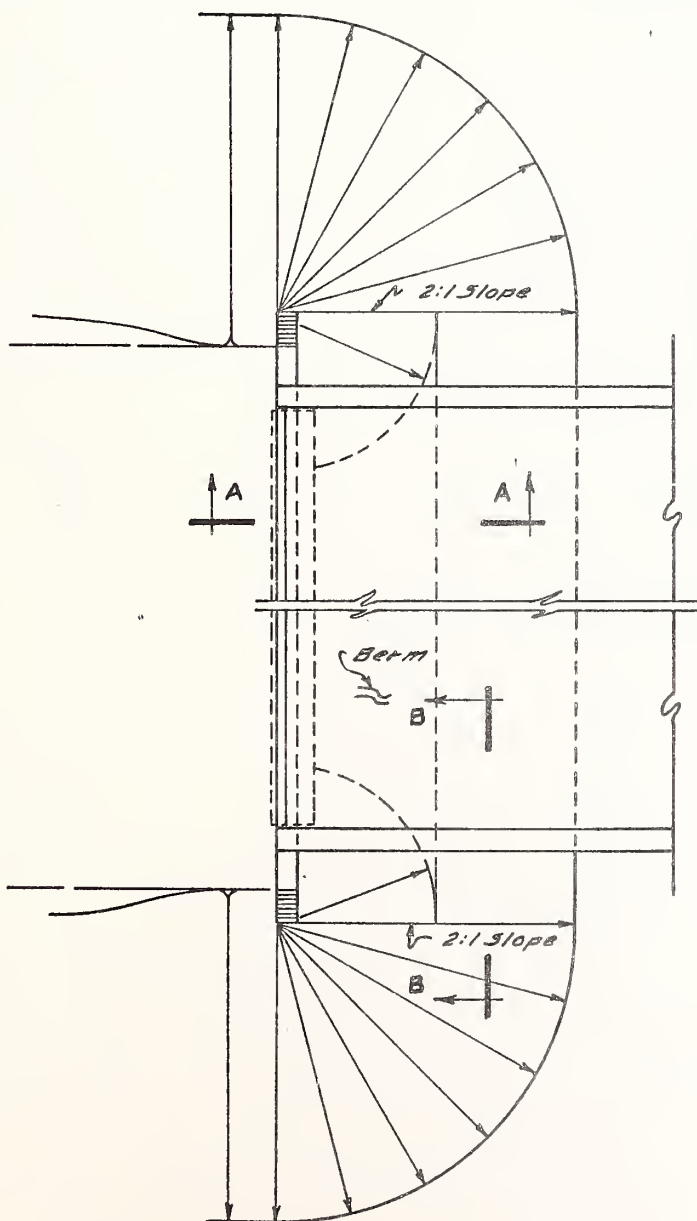
Narrow medians, median widths greater than 76 ft. and independent roadways require special design.
GRADES: Uniform between inside shoulders of main traveled way except for special design.
SURFACING: See plans for quantities.
DRAINAGE: Use 18" or 24" culverts if required.

REVISED	4-16-69	6-1-69	9-23-69	1-29-70		STANDARD DRAWING NO. 11-04
EFFECTIVE	6-1-69	7-1-69	1-1-70	4-1-70		
State Highway Commission Helena, Montana						Approved <i>James M. Sullivan</i> 5/21/69 State Highway Engineer

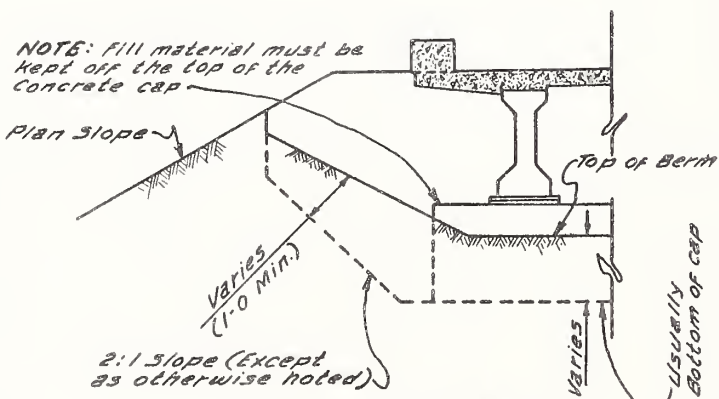
ROADWAY EMBANKMENT AT BRIDGE END



SECTION A-A



PLAN VIEW AT FINISHED BRIDGE END



VIEW B-B
AT FINISHED BRIDGE END

1949, 1950, 1951, 1952, 1953, 1954, 1955, 1956, 1957, 1958, 1959, 1960, 1961, 1962, 1963, 1964, 1965, 1966, 1967, 1968, 1969, 1970, 1971, 1972, 1973, 1974, 1975, 1976, 1977, 1978, 1979, 1980, 1981, 1982, 1983, 1984, 1985, 1986, 1987, 1988, 1989, 1990, 1991, 1992, 1993, 1994, 1995, 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025, 2026, 2027, 2028, 2029, 2030, 2031, 2032, 2033, 2034, 2035, 2036, 2037, 2038, 2039, 2040, 2041, 2042, 2043, 2044, 2045, 2046, 2047, 2048, 2049, 2050, 2051, 2052, 2053, 2054, 2055, 2056, 2057, 2058, 2059, 2060, 2061, 2062, 2063, 2064, 2065, 2066, 2067, 2068, 2069, 2070, 2071, 2072, 2073, 2074, 2075, 2076, 2077, 2078, 2079, 2080, 2081, 2082, 2083, 2084, 2085, 2086, 2087, 2088, 2089, 2090, 2091, 2092, 2093, 2094, 2095, 2096, 2097, 2098, 2099, 2100, 2101, 2102, 2103, 2104, 2105, 2106, 2107, 2108, 2109, 2110, 2111, 2112, 2113, 2114, 2115, 2116, 2117, 2118, 2119, 2120, 2121, 2122, 2123, 2124, 2125, 2126, 2127, 2128, 2129, 2130, 2131, 2132, 2133, 2134, 2135, 2136, 2137, 2138, 2139, 2140, 2141, 2142, 2143, 2144, 2145, 2146, 2147, 2148, 2149, 2150, 2151, 2152, 2153, 2154, 2155, 2156, 2157, 2158, 2159, 2160, 2161, 2162, 2163, 2164, 2165, 2166, 2167, 2168, 2169, 2170, 2171, 2172, 2173, 2174, 2175, 2176, 2177, 2178, 2179, 2180, 2181, 2182, 2183, 2184, 2185, 2186, 2187, 2188, 2189, 2190, 2191, 2192, 2193, 2194, 2195, 2196, 2197, 2198, 2199, 2200, 2201, 2202, 2203, 2204, 2205, 2206, 2207, 2208, 2209, 2210, 2211, 2212, 2213, 2214, 2215, 2216, 2217, 2218, 2219, 2220, 2221, 2222, 2223, 2224, 2225, 2226, 2227, 2228, 2229, 2230, 2231, 2232, 2233, 2234, 2235, 2236, 2237, 2238, 2239, 2240, 2241, 2242, 2243, 2244, 2245, 2246, 2247, 2248, 2249, 2250, 2251, 2252, 2253, 2254, 2255, 2256, 2257, 2258, 2259, 2260, 2261, 2262, 2263, 2264, 2265, 2266, 2267, 2268, 2269, 2270, 2271, 2272, 2273, 2274, 2275, 2276, 2277, 2278, 2279, 2280, 2281, 2282, 2283, 2284, 2285, 2286, 2287, 2288, 2289, 2290, 2291, 2292, 2293, 2294, 2295, 2296, 2297, 2298, 2299, 2300, 2301, 2302, 2303, 2304, 2305, 2306, 2307, 2308, 2309, 2310, 2311, 2312, 2313, 2314, 2315, 2316, 2317, 2318, 2319, 2320, 2321, 2322, 2323, 2324, 2325, 2326, 2327, 2328, 2329, 2330, 2331, 2332, 2333, 2334, 2335, 2336, 2337, 2338, 2339, 2340, 2341, 2342, 2343, 2344, 2345, 2346, 2347, 2348, 2349, 2350, 2351, 2352, 2353, 2354, 2355, 2356, 2357, 2358, 2359, 2360, 2361, 2362, 2363, 2364, 2365, 2366, 2367, 2368, 2369, 2370, 2371, 2372, 2373, 2374, 2375, 2376, 2377, 2378, 2379, 2380, 2381, 2382, 2383, 2384, 2385, 2386, 2387, 2388, 2389, 2390, 2391, 2392, 2393, 2394, 2395, 2396, 2397, 2398, 2399, 2400, 2401, 2402, 2403, 2404, 2405, 2406, 2407, 2408, 2409, 2410, 2411, 2412, 2413, 2414, 2415, 2416, 2417, 2418, 2419, 2420, 2421, 2422, 2423, 2424, 2425, 2426, 2427, 2428, 2429, 2430, 2431, 2432, 2433, 2434, 2435, 2436, 2437, 2438, 2439, 2440, 2441, 2442, 2443, 2444, 2445, 2446, 2447, 2448, 2449, 2450, 2451, 2452, 2453, 2454, 2455, 2456, 2457, 2458, 2459, 2460, 2461, 2462, 2463, 2464, 2465, 2466, 2467, 2468, 2469, 2470, 2471, 2472, 2473, 2474, 2475, 2476, 2477, 2478, 2479, 2480, 2481, 2482, 2483, 2484, 2485, 2486, 2487, 2488, 2489, 2490, 2491, 2492, 2493, 2494, 2495, 2496, 2497, 2498, 2499, 2500, 2501, 2502, 2503, 2504, 2505, 2506, 2507, 2508, 2509, 2510, 2511, 2512, 2513, 2514, 2515, 2516, 2517, 2518, 2519, 2520, 2521, 2522, 2523, 2524, 2525, 2526, 2527, 2528, 2529, 2530, 2531, 2532, 2533, 2534, 2535, 2536, 2537, 2538, 2539, 2540, 2541, 2542, 2543, 2544, 2545, 2546, 2547, 2548, 2549, 2550, 2551, 2552, 2553, 2554, 2555, 2556, 2557, 2558, 2559, 2560, 2561, 2562, 2563, 2564, 2565, 2566, 2567, 2568, 2569, 2570, 2571, 2572, 2573, 2574, 2575, 2576, 2577, 2578, 2579, 2580, 2581, 2582, 2583, 2584, 2585, 2586, 2587, 2588, 2589, 2590, 2591, 2592, 2593, 2594, 2595, 2596, 2597, 2598, 2599, 2600, 2601, 2602, 2603, 2604, 2605, 2606, 2607, 2608, 2609, 2610, 2611, 2612, 2613, 2614, 2615, 2616, 2617, 2618, 2619, 2620, 2621, 2622, 2623, 2624, 2625, 2626, 2627, 2628, 2629, 2630, 26

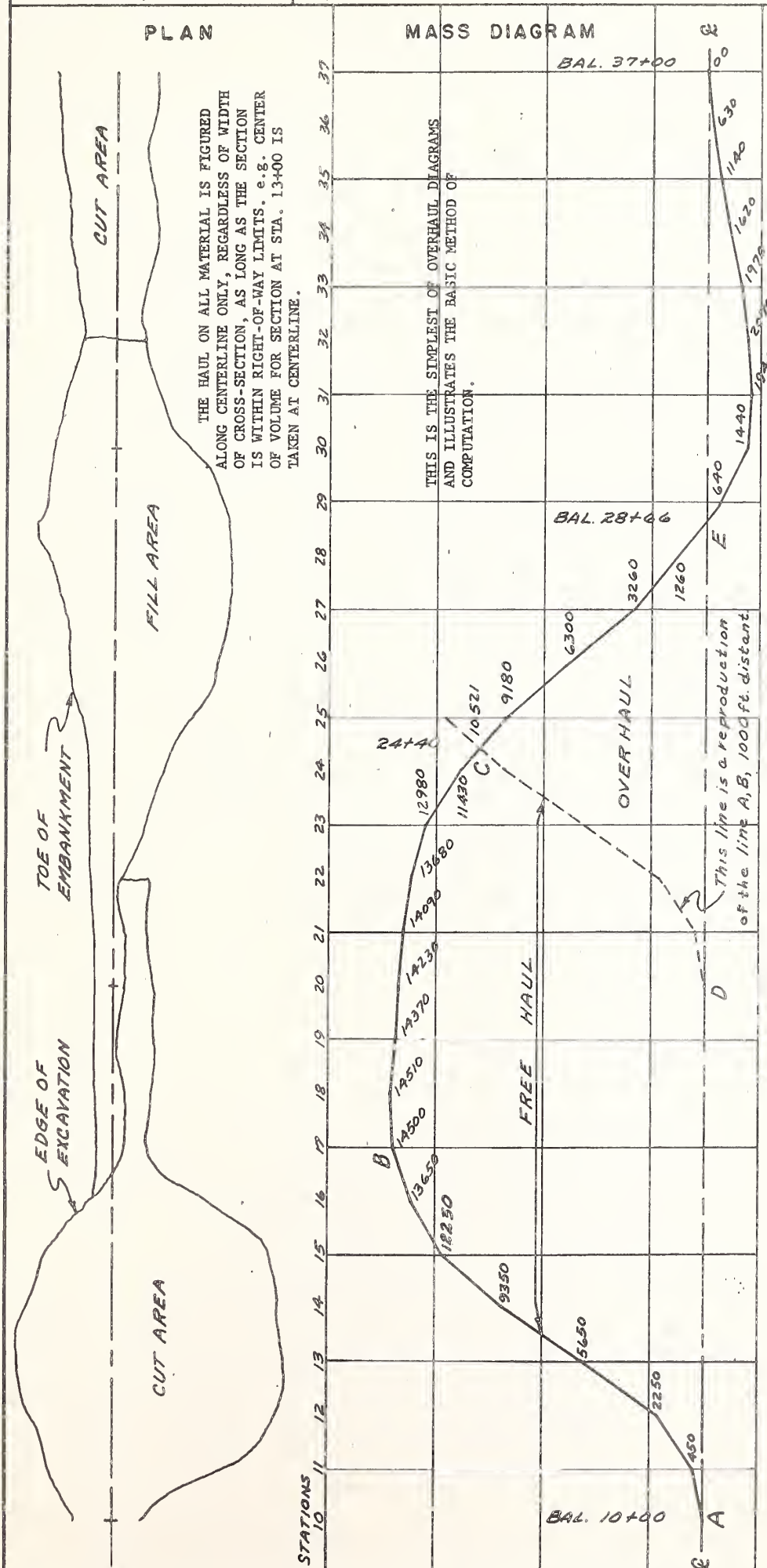
REVISED 12-1-61 10-18-68
EFFECTIVE 12-1-61 1-1-69

STANDARD DRAWING NO. 12-01

State Highway Commission
Helena, Montana

HAUL OR OVERHAUL

Approved
Senior Engineer 10-24-68
State Highway Engineer



FREEHAUL IS REPRESENTED BY THE AREA ABCDA. THE FREEHAUL IS CUSTOMARILY REPRESENTED BY A RECTANGLE 1000 FT. LONG. THIS METHOD PRODUCES THE SAME RESULT.

OVERHAUL IS REPRESENTED BY THE AREA DCED. THE AREA CAN BE DETERMINED BY AT LEAST TWO METHODS. (1) A SERIES OF TRAPEZOIDS FROM D TO E OR (2) DOUBLE MERIDIAN DISTANCE METHOD, FOLLOWING THE PERIMETER FROM E TO C TO D TO E.

OVERHAUL QUANTITIES ARE NOT NORMALLY COMPUTED FROM A PLOTTED MASS LINE, SUCH AS DONE HEREON. EXCAVATION, VOLUME AND MASS QUANTITIES ARE DETERMINED ON COMPUTATION SHEET FORM NO. 16 AND OVERHAUL QUANTITIES DETERMINED FROM THAT.

THIS PARTICULAR EXAMPLE RESULTS IN AN OVERHAUL QUANTITY OF 38,105 STA. YDS. OR 722 MI. YDS.

NOTE:
FOR ITEM OF HAUL DO NOT MAKE FREE HAUL DEDUCTION.

REVISED 7-2-62 10-18-68
EFFECTIVE 7-2-62 1-1-69

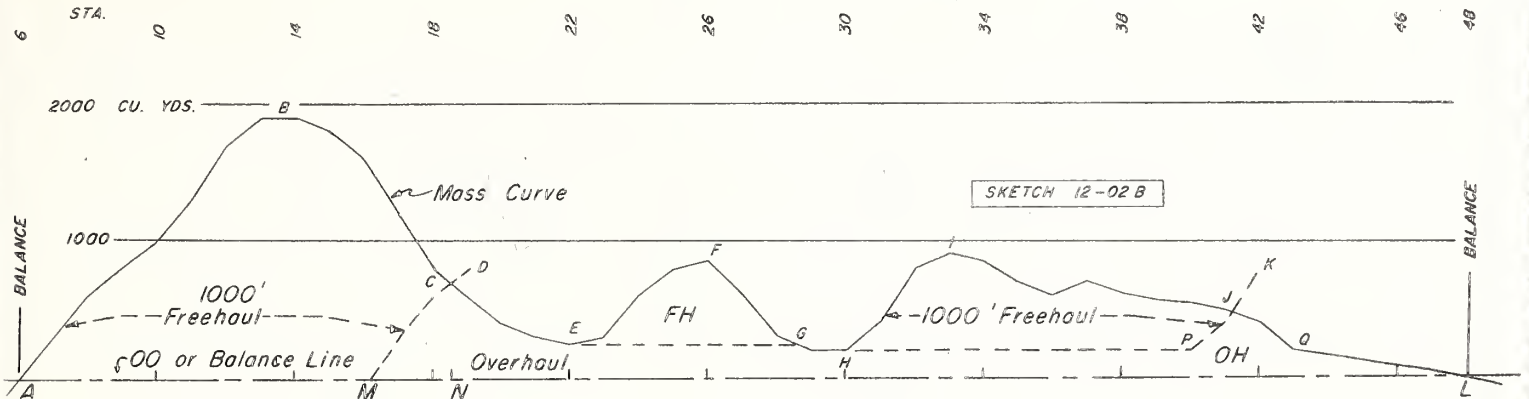
Standard Drawing No. 12-02

State Highway Commission
Helena Montana

HAUL OR OVERHAUL

Approved

James H. Phillips 10-24-68
State Highway Engineer



THE ABOVE SKETCH ILLUSTRATES A Freehaul-Overhaul

SITUATION BETWEEN BALANCE POINTS AT STATIONS 6 AND 48 WITH ALL EXCAVATION AND EMBANKMENT CONCENTRATED ALONG CENTERLINE CROSS-SECTIONS. THE MASS CURVE RISES FROM A TO B, E TO F, AND H TO I REPRESENTING A PREDOMINANCE OF EXCAVATION; IT FALLS FROM B TO E, F TO H, AND I TO L REPRESENTING A SURPLUS OF EMBANKMENT. THE MASS CURVE COULD OCCUR ENTIRELY BELOW THE BALANCE LINE, IN WHICH SITUATION CUT AND FILL QUANTITIES WOULD BE REVERSED.

THE Freehaul AREA ABCMA IS ESTABLISHED BY PLOTTING LINE MD PARALLEL AND 1000 FT. FROM AB TO INTERSECT AT C. THIS DENOTES RESULTANT HAUL FROM STA 6 TOWARD STA 48. IF THE MASS CURVE WAS BELOW THE BALANCE LINE, A LINE LIKE MD WOULD START AT STA 48, GO LEFT AND DOWN, REPRESENTING HAUL

FROM STA. 48 TOWARD STA. 6.

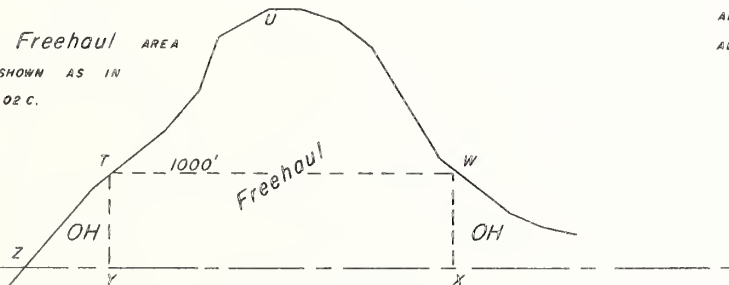
IF AN ADDITIONAL 270 C.Y. OF FILL WERE MADE AHEAD OF STA. 22, (OR 200 C.Y. AT STA. 29-30) A BALANCE WOULD HAVE BEEN ACHIEVED THERE, ELIMINATING CONSIDERABLE Overhaul.

NOTE THE Freehaul AREAS EFGE AND HIJPH; THE FORMER SHOWS BALANCED QUANTITIES BETWEEN E AND G, LESS THAN 1000' APART; THE LATTER A BALANCE BETWEEN H AND J, 1300' APART.

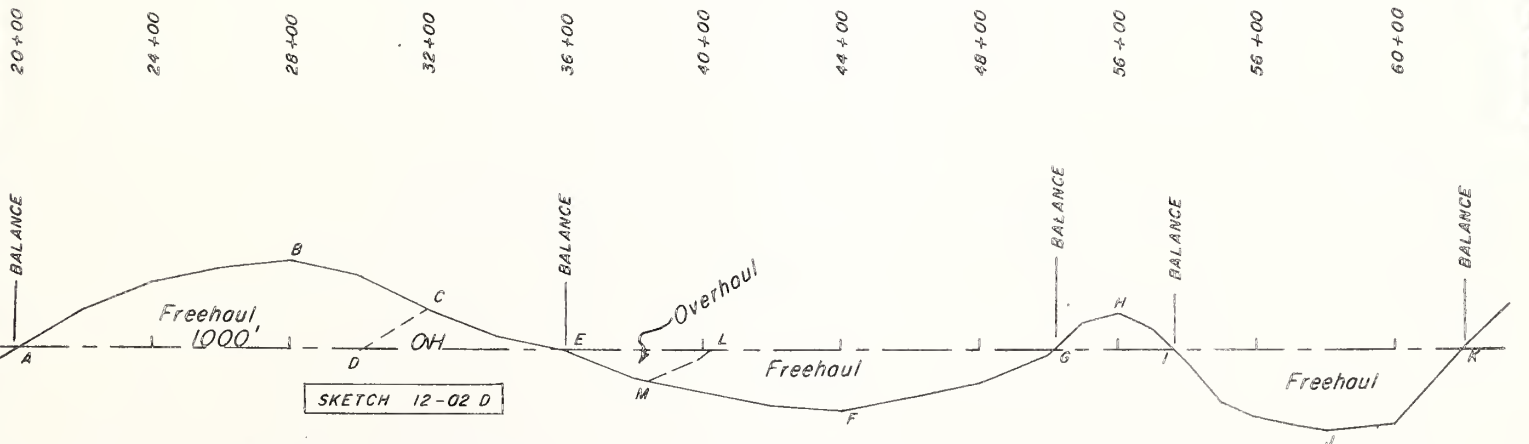
THE CALCULATED AREA OF MDEGHPJLM RESULTS IN STATION YARDS OF Overhaul. DIVISION BY 32.8 RESULTS IN MILE YARDS

WHILE SKETCH 12-02 C SHOWS A DIFFERENT METHOD OF PLOTTING, THE FINAL RESULT IS IDENTICAL, Overhaul AREA Y T Z IS IDENTICAL TO HCM. Freehaul AREA ABCMA IS IDENTICAL TO YTUWXY.

THIS SAME Freehaul AREA WOULD BE SHOWN AS IN SKETCH 12-02 C.



SKETCH 12-02 C



SKETCH 12-02 D

SKETCH 12-02 D REPRESENTS A COMMON OCCURENCE IN A MASS DIAGRAM. THE ALLOWABLE Overhaul SHOWN HERE IS REPRESENTED BY AREAS DCED AND ELME. AREAS GHIG AND IJKI ARE Freehaul, BEING LESS THAN 1000 FT. FROM BALANCE POINT TO BALANCE POINT.

THIS SKETCH MIGHT BE TAKEN TO REPRESENT FINAL QUANTITIES OF EXCAVATION AND EMBANKMENT. IF THE PLANS FOR THE PROJECT SHOWED BALANCE POINTS AT ONLY 20+00 AND 60+00, WITH Overhaul IN THE AMOUNT REPRESENTED BY AREA DCED LISTED THEREIN, THE AMOUNT MUST BE ACCEPTED AS AN ESTIMATE ONLY. FINAL PAYMENT WILL BE MADE ON FINAL MEASURED QUANTITIES ONLY.

NOTE:
For item of haul do not make free haul deduction.

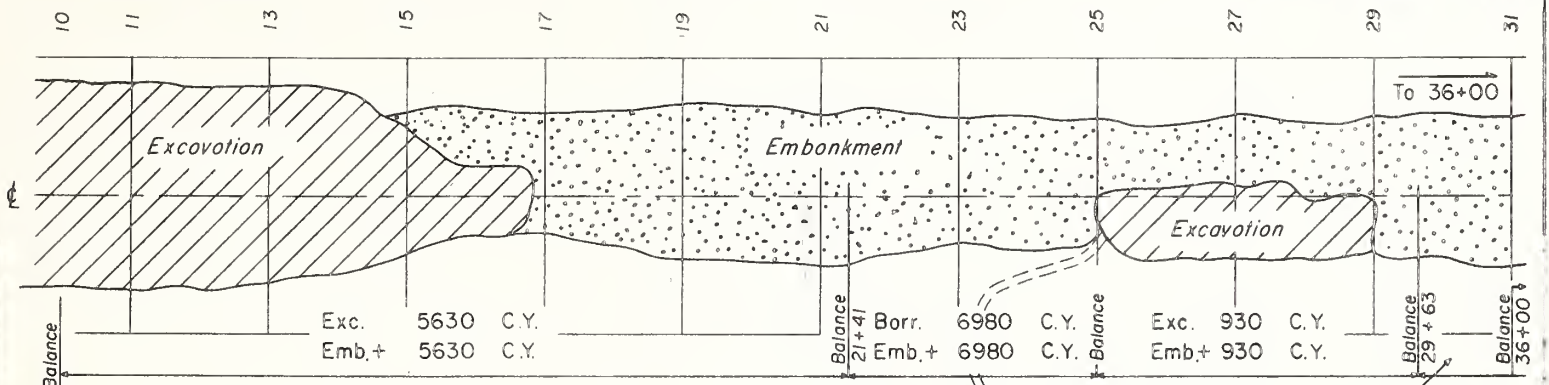
THEY REPRESENT THE FINAL NET HAUL TO EFFECT THE CHANGE FROM ORIGINAL GROUND TO FINAL CROSS-SECTION AND ROADWAY SHAPE -- REGARDLESS OF CROSS-HAUL, BACKWARD AND FORWARD MOVEMENTS OR ANY OTHER MOVES THE CONTRACTOR MIGHT HAVE MADE. SEE STANDARD SPECIFICATIONS AND STANDARD DRAWING 12-01.

DIAGRAM ABCEA REPRESENTS RESULTANT HAUL FROM A TOWARD E; EFGE REPRESENTS RESULTANT HAUL FROM E TOWARD G. THE METHOD OF COMPUTATION OF QUANTITIES IS INDICATED ON STANDARD DRAWING NO. 12-01.

State Highway Commission
Helena, Montana

HAUL OR OVERHAUL

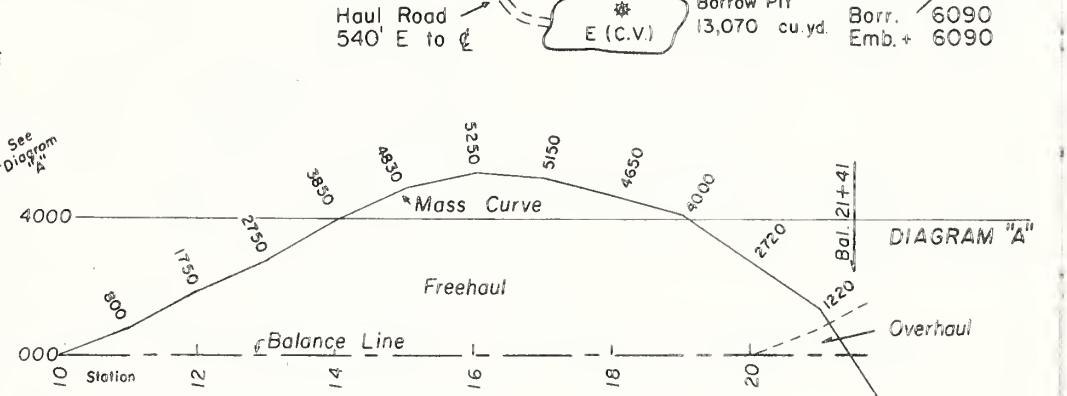
Approved
10-24-68
State Highway Engineer



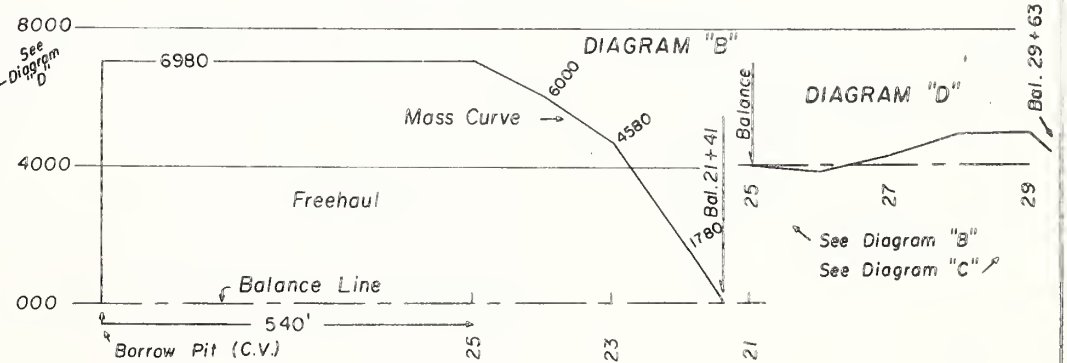
MASS CURVE DATA

Entire Roadway

STA.	EXC.	EMB.+	CUT	FILL	Σ
10			+	-	00
11	800		800		+ 800
12	950		950		1750
13	1000		1000		2750
14	1100		1100		3850
15	980		980		+4830
16	600	180	420		5230
17	200	300		100	5150
18		500		500	4650
19		650		650	4000
20		1280		1280	+2720
21		1500		1500	+1220
22	Bol. 21+41	3000		3000	-1780
23		2800			
24		1500			
25		900			00
26		130		20	- 20
27		250	140		+ 120
28		400	340		+ 460
29		150	00		+ 460
30	Bol. 29+63	730		730	- 270
31		840			
32		900			
33		1080			
34		1210			
35		1040			
36		750			



MASS DIAGRAMS



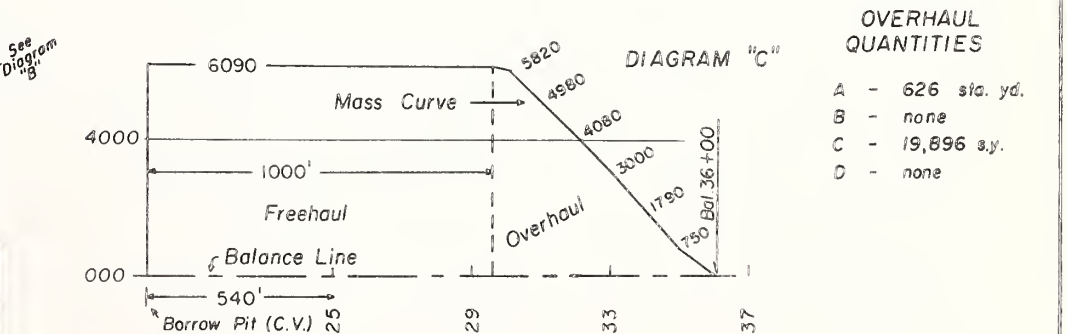
Borrow Quantities

(1) 25 to 21+41

Borrow	6980		6980		00
540'					+6980
25+00					6980
24			900		6000
23			500		4580
22			2800		+1780
21+41			1780		00

(2) 25 to 36+00

Borrow	6090		6090		00
540'					+6090
25+00					6090
463'					6090
29+63					5820
30		270	270		4980
31		840	840		4080
32		900	900		3000
33		1080	1080		1790
34		1210	1210		750
35		1040	1040		00
36		750	750		



OVERHAUL QUANTITIES

- A - 626 sta. yd.
- B - none
- C - 19,896 s.y.
- D - none

This drawing shows one way of determining overhaul in a situation as shown above. Each separate situation is segregated and computed separately. Some engineers would combine the whole into one diagram and arrive at the same answer. The method shown hereon is clear and concise.

The engineer might decide to run a centerline or base line through or alongside the borrow pit and thence to the roadway, rather than find the approximate center of volume. Either way is satisfactory.

NOTE:

For item of haul do not make free haul deduction.

REVISED 11-1-63 10-18-68
EFFECTIVE 11-1-63 1-1-64

STANDARD DRAWING NO. 13-01

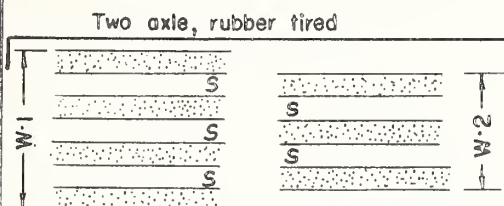
State Highway Commission
Helena, Montana

Measurement Of Roadway Rolling

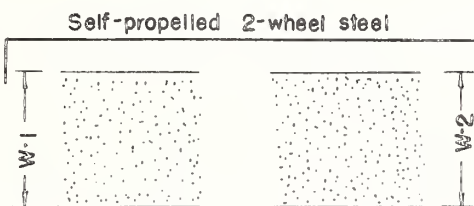
Approved

James H. Phillips 10-28-68
State Highway Engineer

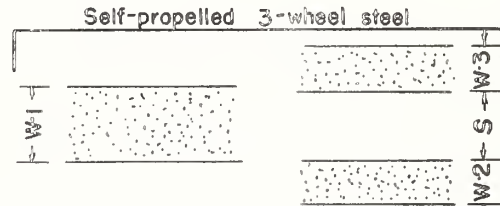
Examples Showing How To Measure Rolling Width. Sketches Show Tracks



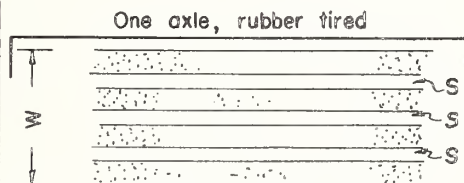
Rolling width = $W-1 + W-2$



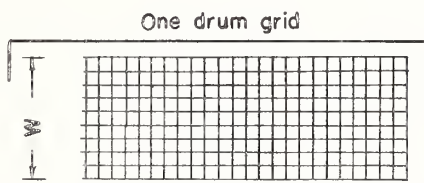
Rolling width = $W-1 + W-2$



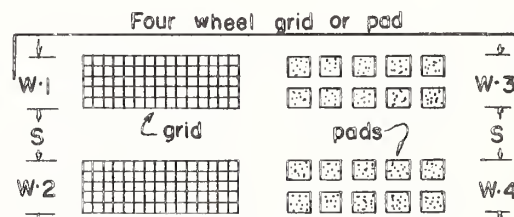
Rolling width = $W-1 + W-2 + W-3$



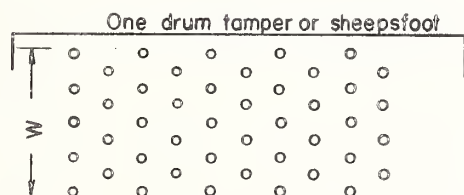
Rolling width = W



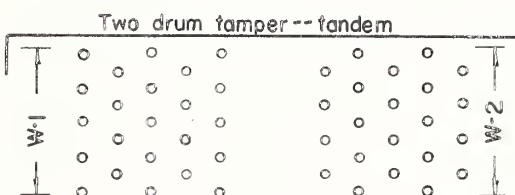
Rolling width = W



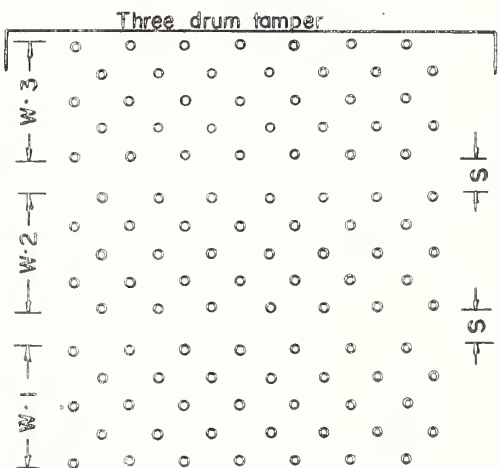
Rolling width = $W-1 + W-2 + W-3 + W-4$



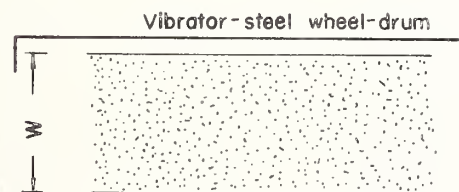
Rolling width = W



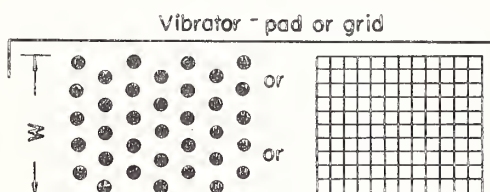
Rolling width = $W-1 + W-2$



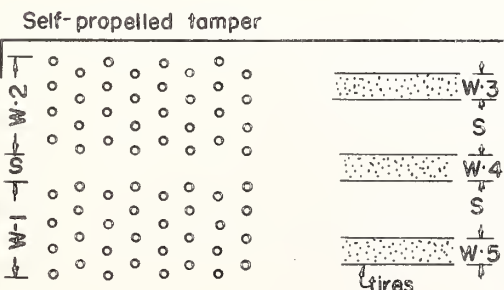
Rolling width = $W-1 + W-2 + W-3$



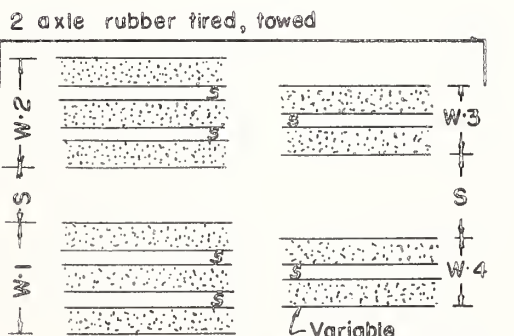
Rolling width = W
see note (b) also



Rolling width = W



Rolling width = $W-1 + W-2 + W-3 + W-4 + W-5$. Number of tires may vary.
see note (c)



Rolling width = $W-1 + W-2 + W-3 + W-4$

- (a) When "S" is more than 12 inches it will not be included in rolling width. "S" is a single measurement, not a summation.
- (b) A 3 drum (steel wheel), with the middle wheel a vibrator, is being used. Measure each drum and add the 3 together.
- (c) One type of vibratory roller with steel drum in rear, rubber tires in front, would be measured like the sketch shows.
- (d) See std. dwg. no. 13-02 for methods of computation for measurement & payment.

Revised	12-30-66	10-18-68	6-1-69		
Effective	2-01-67	1-01-69	7-1-69		STANDARD DRAWING NO. 13 - 02

State Highway Commission
Helena, Montana

MEASUREMENT OF
ROADWAY ROLLING

Approved

Lewis J. Phillips 5/12/69
State Highway Engineer

OPERATING WEIGHTS IN TONS (1)

Total Measured	0-2	2-4	4-6	6-8	8-10	10-12	12-15	15-19	19-24	24-30	30-37	37-45	45-54	54-64	64-75	75-87
20-27	0.314	0.529	0.743	0.958	1.172	1.382	1.600	1.814	2.029	2.243	2.458	2.671	2.886	3.100	3.314	3.529
27-34	0.292	0.507	0.721	0.936	1.150	1.364	1.578	1.792	2.007	2.221	2.436	2.649	2.864	3.078	3.292	3.507
34-41	0.271	0.486	0.700	0.915	1.129	1.343	1.557	1.771	1.986	2.200	2.415	2.628	2.843	3.057	3.271	3.486
41-48	0.249	0.464	0.678	0.893	1.107	1.321	1.535	1.749	1.964	2.178	2.393	2.606	2.821	3.035	3.249	3.464
48-55	0.228	0.443	0.657	0.872	1.086	1.300	1.514	1.728	1.943	2.158	2.372	2.585	2.800	3.014	3.228	3.443
55-60	0.206	0.421	0.635	0.850	1.064	1.278	1.492	1.706	1.921	2.136	2.350	2.563	2.778	2.992	3.206	3.421
60-65	0.185	0.400	0.614	0.829	1.043	1.257	1.471	1.685	1.900	2.115	2.329	2.542	2.757	2.971	3.185	3.400
65-70	0.164	0.379	0.593	0.808	1.022	1.236	1.450	1.664	1.879	2.094	2.308	2.521	2.736	2.950	3.164	3.379
70-75	0.142	0.357	0.571	0.786	1.000	1.214	1.428	1.642	1.857	2.072	2.286	2.500	2.714	2.928	3.142	3.357
75-80	0.121	0.336	0.550	0.765	0.979	1.193	1.407	1.621	1.836	2.051	2.265	2.478	2.693	2.907	3.121	3.336
80-85	0.100	0.314	0.528	0.743	0.957	1.171	1.385	1.600	1.814	2.029	2.243	2.456	2.671	2.885	3.100	3.314
85-90	0.078	0.293	0.507	0.722	0.936	1.150	1.364	1.578	1.793	2.008	2.222	2.435	2.650	2.864	3.078	3.293
90-95	0.056	0.271	0.485	0.700	0.914	1.128	1.342	1.556	1.771	1.986	2.200	2.413	2.628	2.842	3.056	3.271
95-100	0.035	0.250	0.464	0.679	0.893	1.107	1.321	1.535	1.750	1.965	2.179	2.392	2.607	2.821	3.035	3.250
100-105	0.014	0.229	0.443	0.658	0.872	1.086	1.300	1.514	1.729	1.944	2.158	2.371	2.586	2.800	3.014	3.229
105-110		0.207	0.421	0.635	0.850	1.064	1.278	1.492	1.707	1.922	2.136	2.349	2.564	2.778	2.992	3.207
110-115		0.186	0.400	0.615	0.829	1.043	1.257	1.471	1.686	1.901	2.115	2.328	2.543	2.757	2.971	3.186
115-120		0.164	0.378	0.593	0.807	1.021	1.235	1.449	1.664	1.879	2.093	2.306	2.521	2.735	2.949	3.164
120-125			0.357	0.572	0.786	1.000	1.214	1.428	1.643	1.858	2.072	2.285	2.500	2.714	2.928	3.143
125-130			0.335	0.550	0.764	0.978	1.192	1.406	1.621	1.836	2.050	2.263	2.478	2.692	2.906	3.121
130-135			0.314	0.529	0.743	0.957	1.171	1.385	1.600	1.815	2.029	2.243	2.457	2.671	2.885	3.100
135-140			0.293	0.508	0.722	0.936	1.150	1.364	1.579	1.794	2.008	2.221	2.436	2.650	2.864	3.079
140-145			0.271	0.486	0.700	0.914	1.128	1.342	1.557	1.772	1.986	2.200	2.414	2.628	2.842	3.057
145-150			0.250	0.465	0.679	0.893	1.107	1.321	1.536	1.751	1.965	2.178	2.393	2.607	2.821	3.036
150-155			0.228	0.443	0.657	0.871	1.085	1.298	1.514	1.729	1.943	2.156	2.371	2.585	2.800	3.014
155-160				0.422	0.636	0.850	1.064	1.278	1.493	1.708	1.922	2.135	2.350	2.564	2.778	2.993
160-165				0.400	0.614	0.828	1.042	1.256	1.471	1.686	1.900	2.113	2.328	2.542	2.756	2.971
165-170				0.379	0.593	0.807	1.021	1.235	1.450	1.665	1.879	2.092	2.307	2.521	2.735	2.950
170-175				0.358	0.572	0.786	1.000	1.214	1.429	1.644	1.858	2.071	2.286	2.500	2.714	2.929
175-180				0.336	0.550	0.764	0.978	1.192	1.407	1.622	1.836	2.049	2.264	2.478	2.692	2.907
180-185				0.315	0.529	0.743	0.957	1.171	1.386	1.601	1.815	2.028	2.243	2.457	2.671	2.886
185-190				0.293	0.507	0.721	0.935	1.149	1.364	1.579	1.793	2.006	2.221	2.435	2.649	2.864
190-195				0.272	0.486	0.700	0.914	1.128	1.343	1.558	1.772	1.985	2.200	2.414	2.628	2.843
195-200				0.251	0.465	0.679	0.893	1.107	1.322	1.537	1.751	1.964	2.179	2.393	2.607	2.822
200-205				0.229	0.443	0.657	0.871	1.085	1.300	1.515	1.729	1.942	2.157	2.371	2.585	2.800
205-210				0.208	0.422	0.636	0.850	1.064	1.289	1.494	1.708	1.921	2.136	2.350	2.564	2.779
210-215				0.187	0.401	0.615	0.829	1.043	1.268	1.473	1.687	1.900	2.115	2.329	2.543	2.758

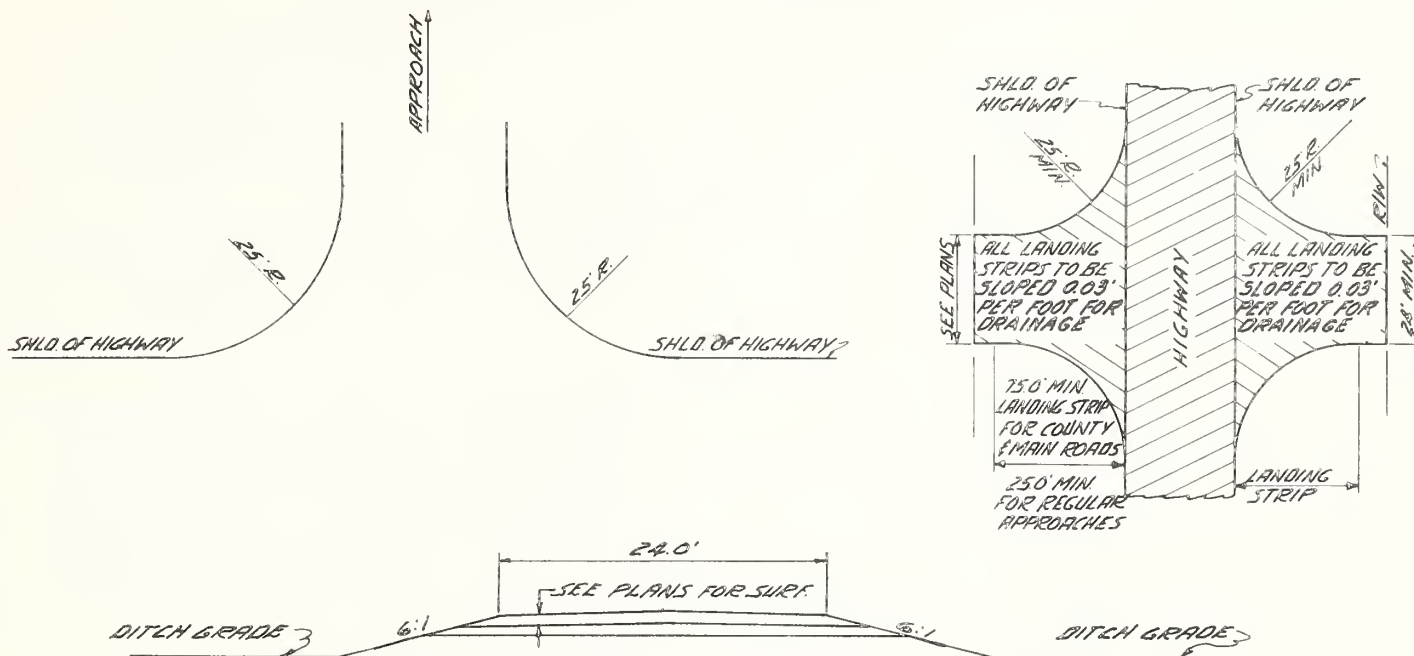
- Operating weight in tons. "10-12" means ten tons or more but less than twelve.
- Rolling width means total width of track or tracks made by roller, measured in inches. See Standard Drawing No. 13-01. "48-55" means 48" or more, but less than 55", etc.
- When the drive wheels or drums of a power unit are designed and constructed for rolling and compacting, then such wheels or drums will be included in rolling width.
- When the roller is a vibrating type, the factor in Drawing 13-02 is to be multiplied by 2 to determine pay quantity. The weight to be used is the operating weight.
- When the roller is a towed tamping roller, multiply the factor in Drawing 13-02 by 1.50 to determine pay quantity.
- When more than one roller is pulled by only one power unit, measure all rollers and add together as a team combined into one roller.
- The power unit is not to be included in any measurements when the rolling equipment is being towed.
- For roller widths and roller weights not on the table, project at same rates within the table. All projections computed in field offices must be approved prior to use, by the Helena Office.
- Illustrative computation of pay quantity:
 - Measure rolling width! Answer---157 inches
 - Determine operating weight. Answer 34.5 tons
 - The pay time for the roller in a pay period is 210 hours.
 - Look in Drawing 13-02 on the line including 157" (155-160), under the column including 34.5 tons (30-37), find unit value of 1.922
 - Multiply 1.922 by 210, getting 403.6 units.

State Highway Commission
Helena, Montana

APPROACHES

Approved

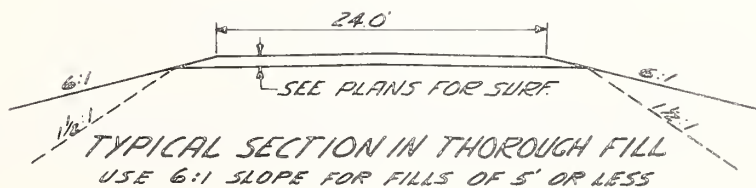
Lewis M. Sullivan
State Highway Engineer



TYPICAL SECTION AT 25' DITCH LINE

FOR LOW VOLUME ROADS SEE STANDARD SHEET NO. 38,
FUTURE ADT OF LESS THAN 50 USE V TYPE DITCH WHICH VARIES
FROM 15" MINIMUM TO 25" MAXIMUM.

FOR DRAINAGE - PIPE AS NECESSARY



GRADE OF APPROACH NOT TO EXCEED 10% UNLESS TRAFFIC
VOLUME AND COST INDICATE SUCH TO BE JUSTIFIABLE.

APPROACHES TO BE CONSTRUCTED TO FIT LOCAL CONDITIONS
BUT IN SUCH MANNER AS TO MINIMIZE TRAFFIC HAZARDS AND
AFFORD SAFE AND COMMODIOUS ENTRY AND EXIT OF TRAFFIC TO
AND FROM MAIN ROAD.

WHERE IT BECOMES NECESSARY TO GO BEYOND RIGHT-OF-WAY
LINES, WRITTEN PERMISSION SHALL BE SECURED FROM PROPERTY
OWNER IN ALL INSTANCES.

REVISED 3-3-67 10-25-68
EFFECTIVE 6-1-67 1-1-69

STANDARD DRAWING NO. 39-01

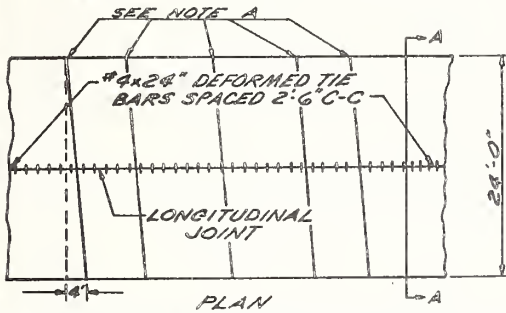
State Highway Commission
Helena, Montana

8" P. C. CONCRETE PAVEMENT SAWED JOINTS WITH TIE BARS

Approved
James M. Phillips
State Highway Engineer

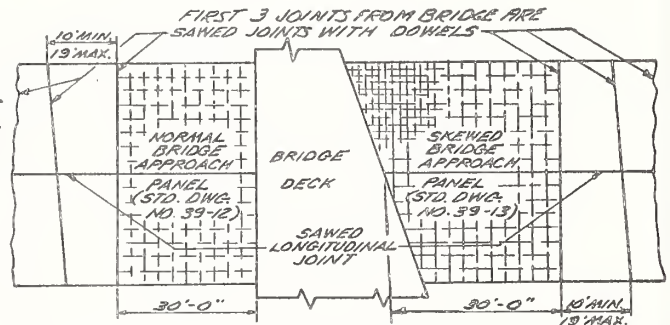
8" X 24' PLAIN P.C. CONCRETE PAVEMENT

SAWED CONTRACTION JOINTS



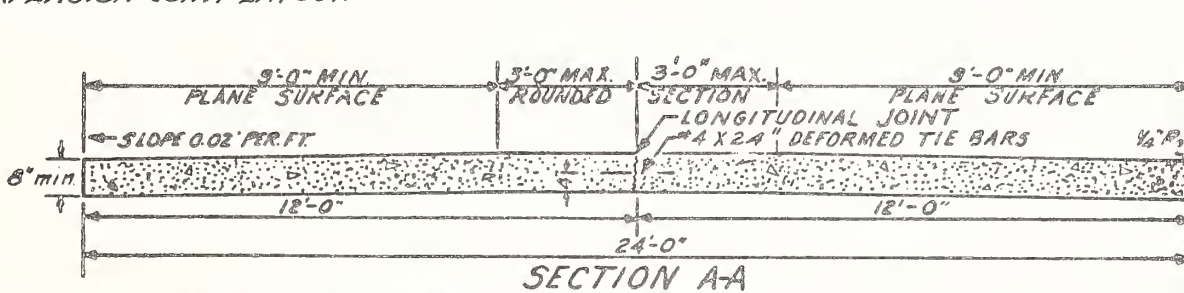
NOTE C: CONTRACTION JOINTS SHALL BE CONSTRUCTED AT LEAST 5' FROM ANY CONSTRUCTION JOINT (STD. DWG. NO. 39-04).

NOTE A: CONTRACTION JOINTS SHALL BE SAWED DIAGONALLY AS SHOWN ABOVE UNLESS SHOWN OTHERWISE ON THE PLANS. OFFSET = 4" IN 24" AND SKEWED COUNTERCLOCKWISE TO THE DIRECTION OF TRAFFIC MOVEMENT. SPACING OF THE JOINTS SHALL BE 13', 19', 18', 12' AND REPEAT EXCEPT FOR THE FIRST JOINT AT BRIDGE APPROACH PANELS OR EXPANSION JOINT LAYOUT.



SAWED JOINT DETAIL FOR BRIDGE APPROACH PANELS

NOTE B: THE 10' MIN. AND 19' MAX. DIMENSIONS SHOWN ABOVE ARE ALSO APPLICABLE FOR THE FIRST CONTRACTION JOINT ON EITHER SIDE OF AN EXPANSION JOINT LAYOUT (STD. DWG. NO. 39-02).

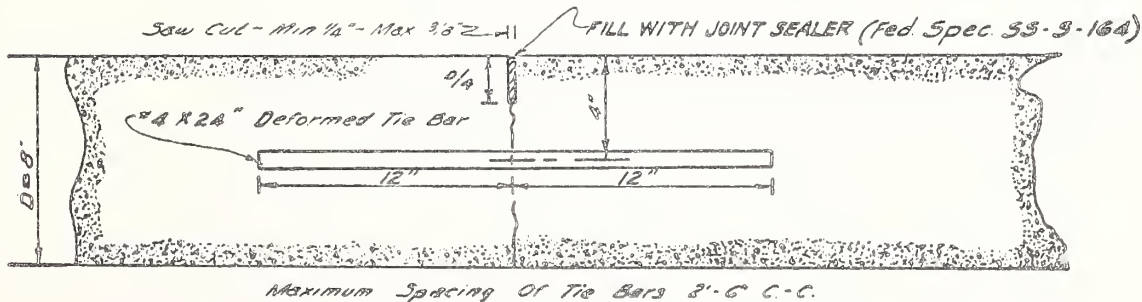


FOR CONTRACTION JOINT DETAILS SEE STD. DWG. NO. 39-03

FOR LOCATION AND DETAILS OF DOWELED CONTRACTION JOINTS SEE STD. DWG. NO. 39-03

DEFORMED TIE BARS TO BE INCLUDED IN UNIT PRICE BID FOR P. C. CONCRETE PAVEMENT.

SAWED LONGITUDINAL JOINT WITH DEFORMED TIE BARS



TIE BARS MAY BE INSTALLED AFTER THE CONCRETE HAS BEEN STRUCK OFF AND PRIOR TO FINAL FINISHING, BY AN INSTALLING DEVICE, PREVIOUSLY APPROVED BY THE ENGINEER, WHICH WILL PLACE THE TIE BARS IN THE REQUIRED POSITIONS AND LOCATION.

TIE BARS PLACED IN ADVANCE OF CONCRETE PLACING OPERATIONS SHALL BE RIGIDLY AND SECURELY SUPPORTED IN THE REQUIRED POSITION AT THE JOINT BY CHAIRS, STAKES AND/OR SUPPORTING DEVICES. THE SUPPORTING DEVICES MAY BE FACTORY ASSEMBLED. THE CONTRACTOR SHALL FURNISH THE ENGINEER WITH DETAIL DRAWINGS OF THESE DEVICES, A SUFFICIENT TIME IN ADVANCE OF CONSTRUCTION, FOR HIS APPROVAL. ANY APPROVAL OF DRAWINGS OF THESE DEVICES SHALL BE CONSIDERED TENTATIVE AND FINAL APPROVAL SHALL BE CONTINGENT UPON THEIR SATISFACTORY PERFORMANCE.

SEE STANDARD SPECIFICATIONS ARTICLE 39.04 (K)(4) FOR SAWED JOINT.

THE COST OF THE TIE BARS, JOINT SEALER, AND SUPPORTING DEVICES SHALL BE INCLUDED IN THE UNIT PRICE BID PER SQUARE YARD OF P. C. CONCRETE PAVEMENT.

NOTE: THIS JOINT MAY BE USED AT OTHER LOCATIONS IF CALLED FOR ON THE PLANS.

REVISED 11-1-62
EFFECTIVE 11-1-62

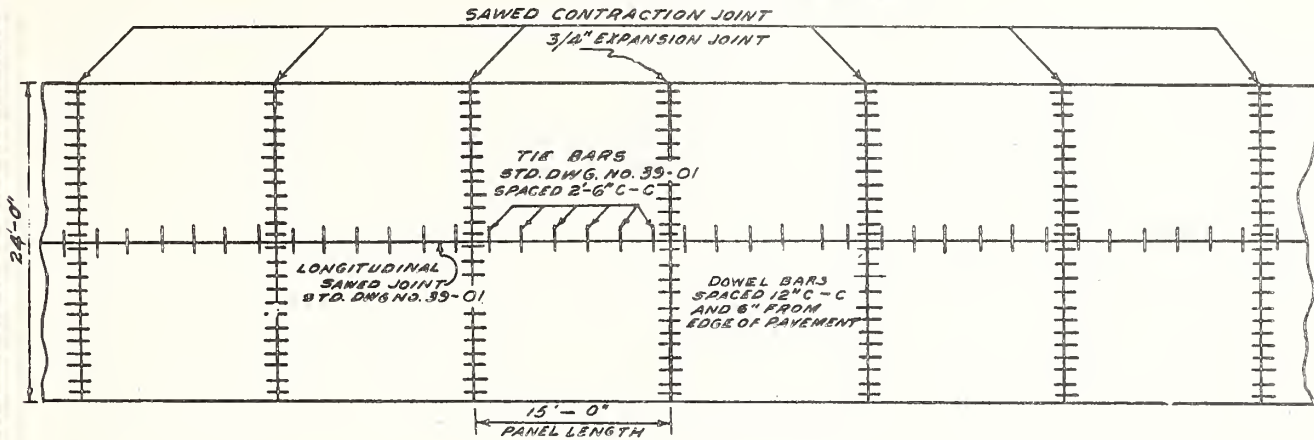
STANDARD DRAWING NO. 39-02

State Highway Commission
Helena, Montana

8" P.C. CONCRETE PAVEMENT EXPANSION JOINTS & DOWEL SLEEVES

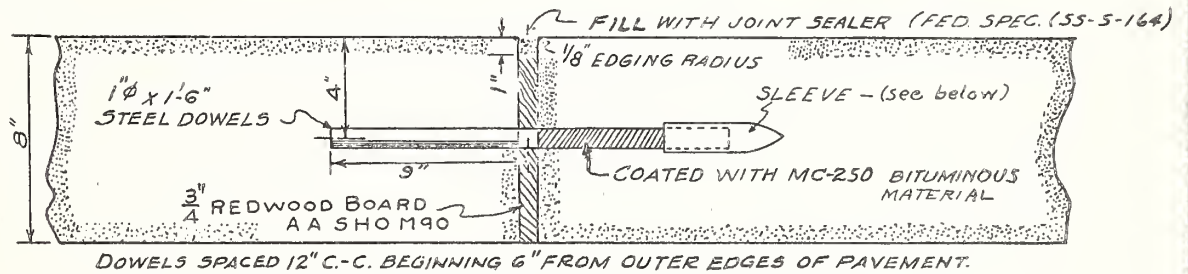
Approved
James M. Hillman 10-25-68
State Highway Engineer

EXPANSION JOINT LAYOUT



3/4" EXPANSION JOINT, . . . TO BE FILLED WITH REDWOOD BOARD AND JOINT SEALER. SMOOTH STEEL DOWELS WITH SLEEVES AT EXPANSION JOINT. SMOOTH STEEL DOWELS WITHOUT SLEEVES, STD. DWG. NO. 39-03, COATED WITH MC-250 BITUMINOUS MATERIAL FOR ONE-HALF THE LENGTH OF THE DOWEL, INSTALLED IN SAWED CONTRACTION JOINT, THE FIRST THREE CONTRACTION JOINTS EACH SIDE OF EXPANSION JOINT.

EXPANSION JOINT



DOWELS TO BE PROVIDED WITH DOWEL SLEEVES

ONE-HALF THE LENGTH OF THE DOWEL ON WHICH THE SLEEVE IS PLACED SHALL BE THOROUGHLY COATED WITH MC-250 BITUMINOUS MATERIAL OR HEAVY GREASE. SLEEVES TO BE PLACED ON ALTERNATE ENDS OF DOWEL BARS

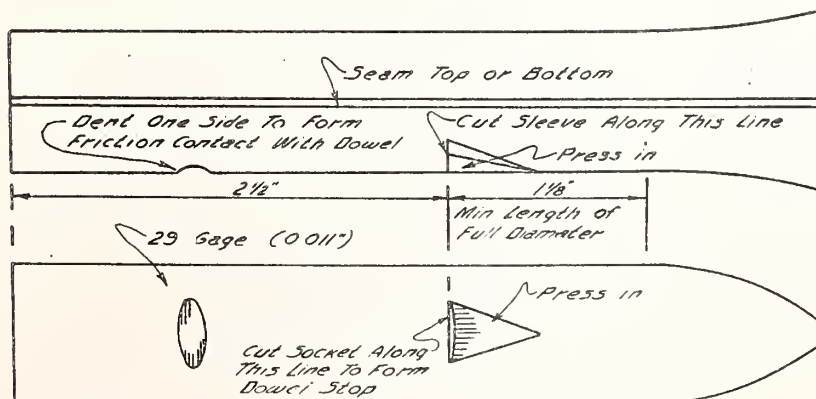
THE REDWOOD BOARD EXPANSION JOINT FILLER, AASHTO DES. M-90 SHALL CONFORM TO THE DIMENSIONS SHOWN AND CUT TO FIT THE CROWN AND SUBGRADE.

THE CONTRACTOR SHALL FURNISH CHAIRS, STAKES, AND/OR SUPPORTING DEVICES CAPABLE OF HOLDING THE DOWELS AND JOINT FILLER, SECURELY AND RIGIDLY, IN THEIR REQUIRED POSITIONS. THE DOWEL AND JOINT FILLER SUPPORTING DEVICES MAY BE FACTORY ASSEMBLED. THE CONTRACTOR SHALL FURNISH THE ENGINEER WITH DETAIL DRAWINGS OF THESE DEVICES, A SUFFICIENT TIME IN ADVANCE OF CONSTRUCTION, FOR HIS APPROVAL. ANY APPROVAL OF DRAWINGS OF THESE DEVICES SHALL BE CONSIDERED TENTATIVE AND FINAL APPROVAL SHALL BE CONTINGENT UPON THEIR SATISFACTORY PERFORMANCE.

DOWEL SLEEVE FOR 1" DOWEL BARS



DOWEL SLEEVE SHALL BE SNUG FITTING.



End Closed By Pinching Sides Together or Other Approved Means

SLEEVES TO BE PLACED ON ALTERNATE OPPOSITE ENDS OF DOWELS. HALF THE LENGTH OF THE DOWEL, ON THE END ON WHICH THE SLEEVE IS PLACED, SHALL BE THOROUGHLY COATED WITH MC-250 BITUMINOUS MATERIAL OR HEAVY GREASE TO BREAK THE BOND.

DOWELS, DOWEL SLEEVES, JOINT FILLER MC-250 AND SEALER, TOGETHER WITH THE SUPPORTING DEVICES NECESSARY FOR THE PROPER INSTALLATION OF THE JOINT, SHALL BE INCLUDED IN THE UNIT PRICE BID PER SQUARE YARD FOR P. C. CONCRETE PAVEMENT.

REVISED 3-1-66
EFFECTIVE 3-1-66

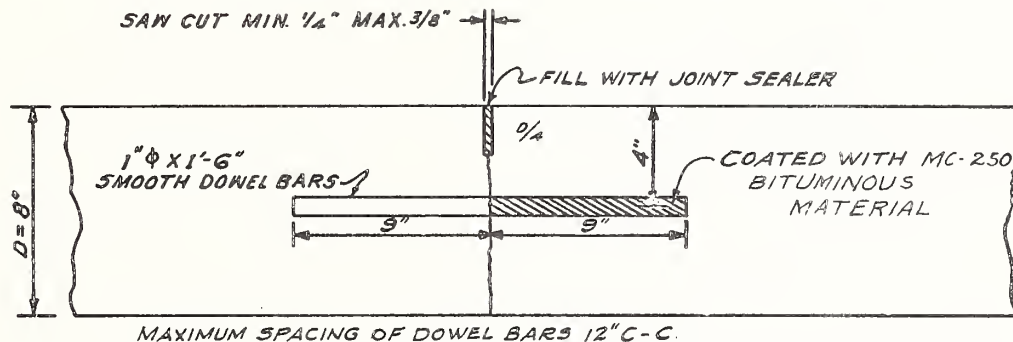
STANDARD DRAWING NO. 39-03

State Highway Commission
Helena, Montana

8" P.C. CONCRETE PAVEMENT SAWED JOINTS

Approved
James M. Dilling 10-25-68
State Highway Engineer

SAWED JOINT WITH DOWEL BARS

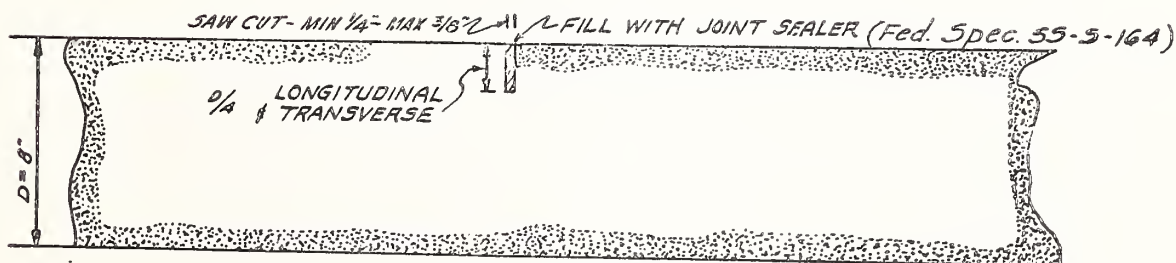


ONE-HALF LENGTH OF THE DOWEL BARS ON ALTERNATE ENDS SHALL BE THOROUGHLY COATED WITH MC-250 BITUMINOUS MATERIAL OR HEAVY GREASE.

THE CONTRACTOR SHALL FURNISH CHAIRS, STAKES AND/OR SUPPORTING DEVICES CAPABLE OF HOLDING THE DOWELS SECURELY AND RIGIDLY, IN THEIR REQUIRED POSITIONS. THE DOWEL SUPPORTING DEVICES MAY BE FACTORY ASSEMBLED. THE CONTRACTOR SHALL FURNISH THE ENGINEER WITH DETAIL DRAWINGS OF THESE DEVICES, A SUFFICIENT TIME IN ADVANCE OF CONSTRUCTION, FOR HIS APPROVAL. ANY APPROVAL OF DRAWINGS OF THESE DEVICES SHALL BE CONSIDERED TENTATIVE AND FINAL APPROVAL SHALL BE CONTINGENT UPON THEIR SATISFACTORY PERFORMANCE.

DOWEL BARS MAY BE PLACED BY MECHANICAL EQUIPMENT IF APPROVED BY THE ENGINEER.

SAWED CONTRACTION JOINT



SEE STANDARD SPECIFICATIONS, ARTICLE 39.04(K)(4) FOR SAWED CONTRACTION JOINT DETAILS.

WHERE INTEGRAL CURB IS CALLED FOR, THE JOINT SHALL BE CONTINUED THROUGH THE INTEGRAL CURB.

THE COST OF JOINT SEALER, DOWEL BARS, SUPPORTING DEVICES AND CONSTRUCTING THE SAWED JOINT SHALL BE INCLUDED IN THE UNIT PRICE BID PER SQUARE YARD OF P. C. CONCRETE PAVEMENT.

REVISED 3-1-66 5-21-69
EFFECTIVE 3-1-66 7-1-69

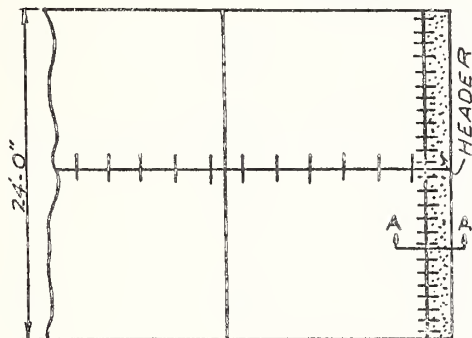
STANDARD DRAWING NO. 39-04

State Highway Commission
Helena, Montana

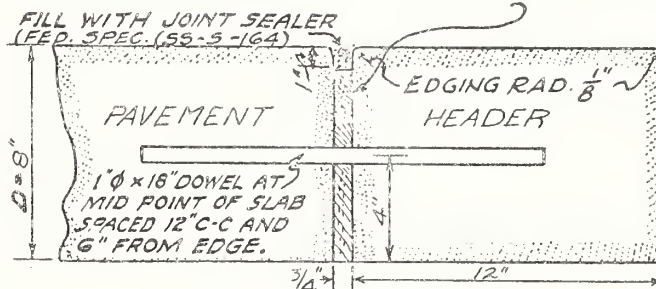
8" P.C. CONCRETE PAVEMENT CONSTRUCTION JOINT & HEADER

Approved
State Highway Engineer

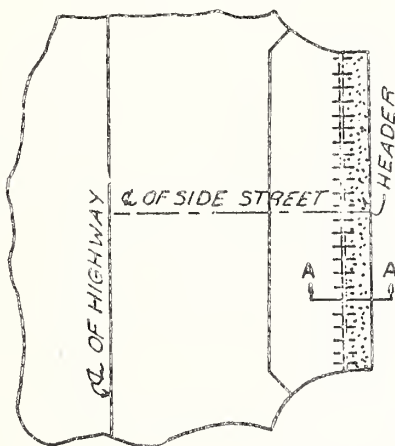
HEADER



3/4" BOARD TO BE SHAPED
TO PAVEMENT CROSS-SECTION
& LEFT IN PLACE



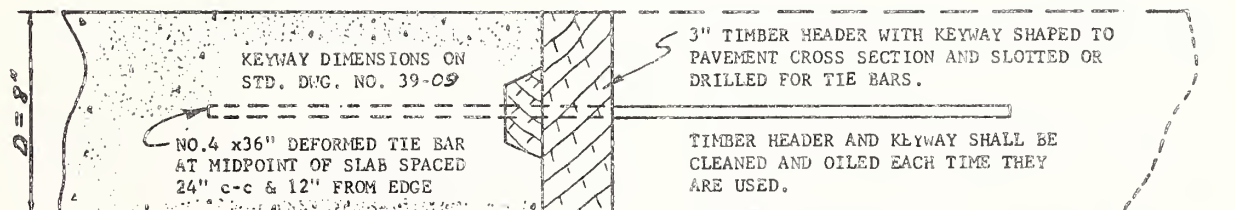
SECTION A-A



HEADERS TO BE CONSTRUCTED AT BEGINNING AND END OF PAVEMENT,
AT INTERSECTING ROADS AND STREET RETURNS WHERE FUTURE P. C. CON-
CRETE PAVEMENT MAY BE CONSTRUCTED.

THE CONTRACTOR SHALL FURNISH CHAIRS, STAKES AND/OR SUPPORT-
ING DEVICES CAPABLE OF HOLDING THE DOWELS, AND JOINT FILLER, SE-
CURELY AND RIGIDLY, IN THEIR REQUIRED POSITIONS. THE DOWEL AND
JOINT FILLER SUPPORTING DEVICES MAY BE FACTORY ASSEMBLED. THE
CONTRACTOR SHALL FURNISH THE ENGINEER WITH DETAIL DRAWINGS OF
THESE DEVICES, A SUFFICIENT TIME IN ADVANCE OF CONSTRUCTION, FOR
HIS APPROVAL. ANY APPROVAL OF DRAWINGS OF THESE DEVICES SHALL
BE CONSIDERED TENTATIVE AND FINAL APPROVAL SHALL BE CONTINGENT
UPON THEIR SATISFACTORY PERFORMANCE.

CONSTRUCTION JOINT

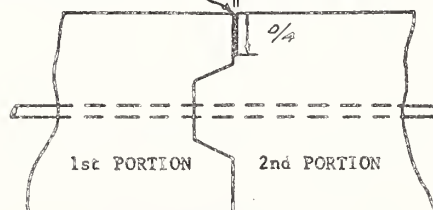


3" TIMBER HEADER WITH KEYWAY SHAPED TO
PAVEMENT CROSS SECTION AND SLOTTED OR
DRILLED FOR TIE BARS.

TIMBER HEADER AND KEYWAY SHALL BE
CLEANED AND OILED EACH TIME THEY
ARE USED.

FILL WITH JOINT SEALER
(FED. SPEC. SS-S-164)

SAW CUT
MIN. 1/4" MAX. 3/8"



DETAIL OF
COMPLETED JOINT

CONSTRUCTION JOINT TO BE INSTALLED AT THE END
OF EACH DAYS RUN OR WHERE AN INTERRUPTION IN CON-
CRETE OPERATIONS OF MORE THAN 30 MINUTES OCCURS.
TIMBER HEADER AND KEYWAY STRIP SHALL BE REMOVED
WHEN CONCRETE OPERATIONS ARE RESUMED AND FRESH
CONCRETE PLACED DIRECTLY AGAINST THE OLD.

SMOOTH STEEL DOWELS, 3/4"
BOARD JOINT SEALER, TIMBER HEADER
WITH KEYWAY, JOINT SEALER, AND
SUPPORTING DEVICES TO BE INCLUDED
IN THE UNIT PRICE BID PER SQUARE YARD
FOR P. C. CONCRETE PAVEMENT.

REVISED 3-1-66
EFFECTIVE 3-1-66

STANDARD DRAWING NO. 39-09

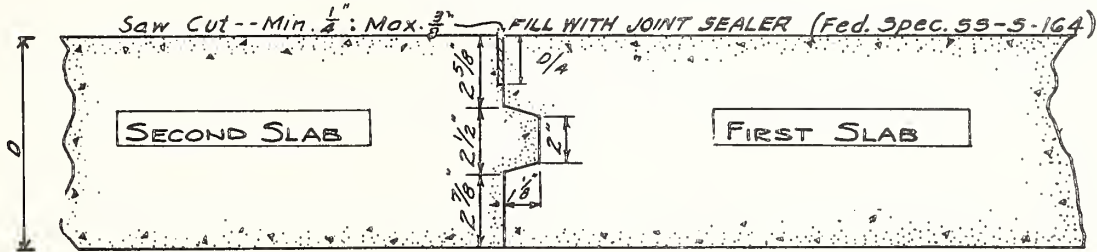
State Highway Commission
Helena, Montana

8" P.C. CONCRETE PAVEMENT KEYWAY JOINTS

Approved

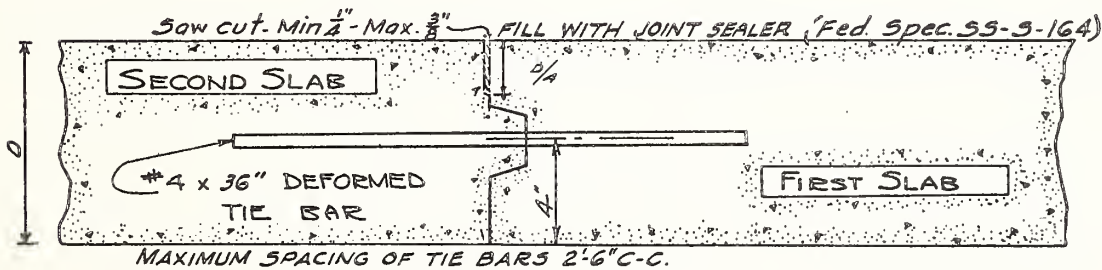
James M. Chilton 10-25-68
State Highway Engineer

LONGITUDINAL KEYWAY JOINT



KEYWAY JOINT (1 1/8"x2") MAY BE FORMED WITH WOOD STRIP OR APPROVED METAL FORM. KEYWAY FORMS SHALL BE CLEANED AND OILED EACH TIME THEY ARE USED.

LONGITUDINAL KEYWAY JOINT WITH TIE BARS



LONGITUDINAL KEYWAY JOINTS SHALL BE USED WHEN PAVEMENT IS CONSTRUCTED IN SINGLE ALTERNATE LANES AND WITH DEFORMED TIE BARS WHEN CALLED FOR ON THE PLANS.

DEFORMED TIE BARS SHALL BE RIGIDLY AND SECURELY SUPPORTED IN THE REQUIRED POSITION AT THE JOINT, BY CHAIRS, STAKES AND/OR SUPPORTING DEVICES. THE SUPPORTING DEVICES MAY BE FACTORY ASSEMBLED. THE CONTRACTOR SHALL FURNISH THE ENGINEER WITH DETAIL DRAWINGS OF THESE DEVICES, A SUFFICIENT TIME IN ADVANCE OF CONSTRUCTION,

FOR HIS APPROVAL. ANY APPROVAL OF DRAWINGS OF THESE DEVICES SHALL BE CONSIDERED TENTATIVE AND FINAL APPROVAL SHALL BE CONTINGENT UPON THEIR SATISFACTORY PERFORMANCE. JOINT MAY BE USED AT OTHER LOCATIONS IF CALLED FOR ON THE PLANS.

DEFORMED TIE BARS, JOINT MATERIALS AND SUPPORTING DEVICES ARE TO BE INCLUDED IN THE UNIT PRICES BID PER SQUARE YARD FOR P. C. CONCRETE PAVEMENT.

REVISED 8-1-63
EFFECTIVE 8-1-63

STANDARD DRAWING NO. 39-10

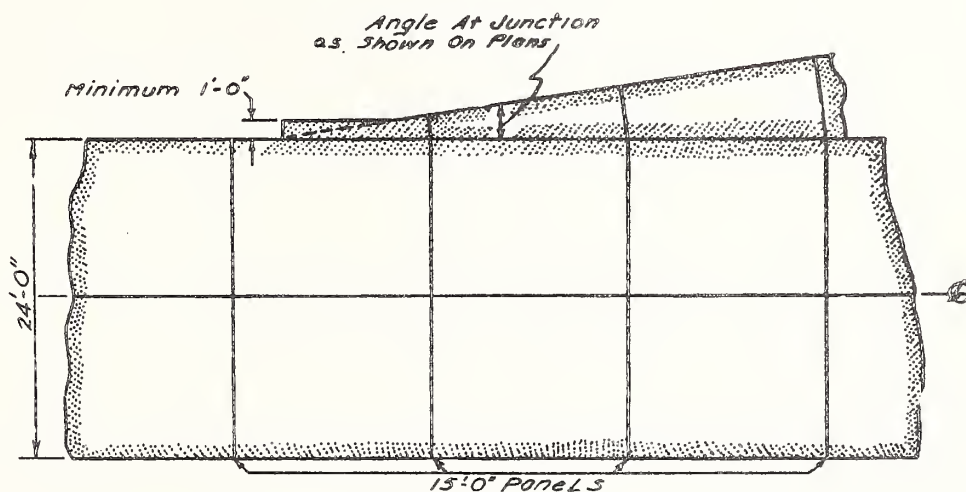
State Highway Commission
Helena, Montana

P.C. CONCRETE PAVEMENT TAPERED PANEL CONNECTION

Approved

Louis H. Sullivan 10-25-68
State Highway Engineer

TAPERED PANEL CONNECTION



Tapered section along junction and where pavement is to be widened shall be constructed with a minimum width of one foot. The joint at the junction shall be a longitudinal keyway joint with tie bars conforming to Std. Dwg. No. 39-09

Transverse contraction and/or expansion joints along the junction shall be the same in the adjoining pavement and continuous with those in the main roadway pavement.

Tie bars, dowels and joint sealer to be included in the unit price bid per square yard of P.C. concrete pavement.

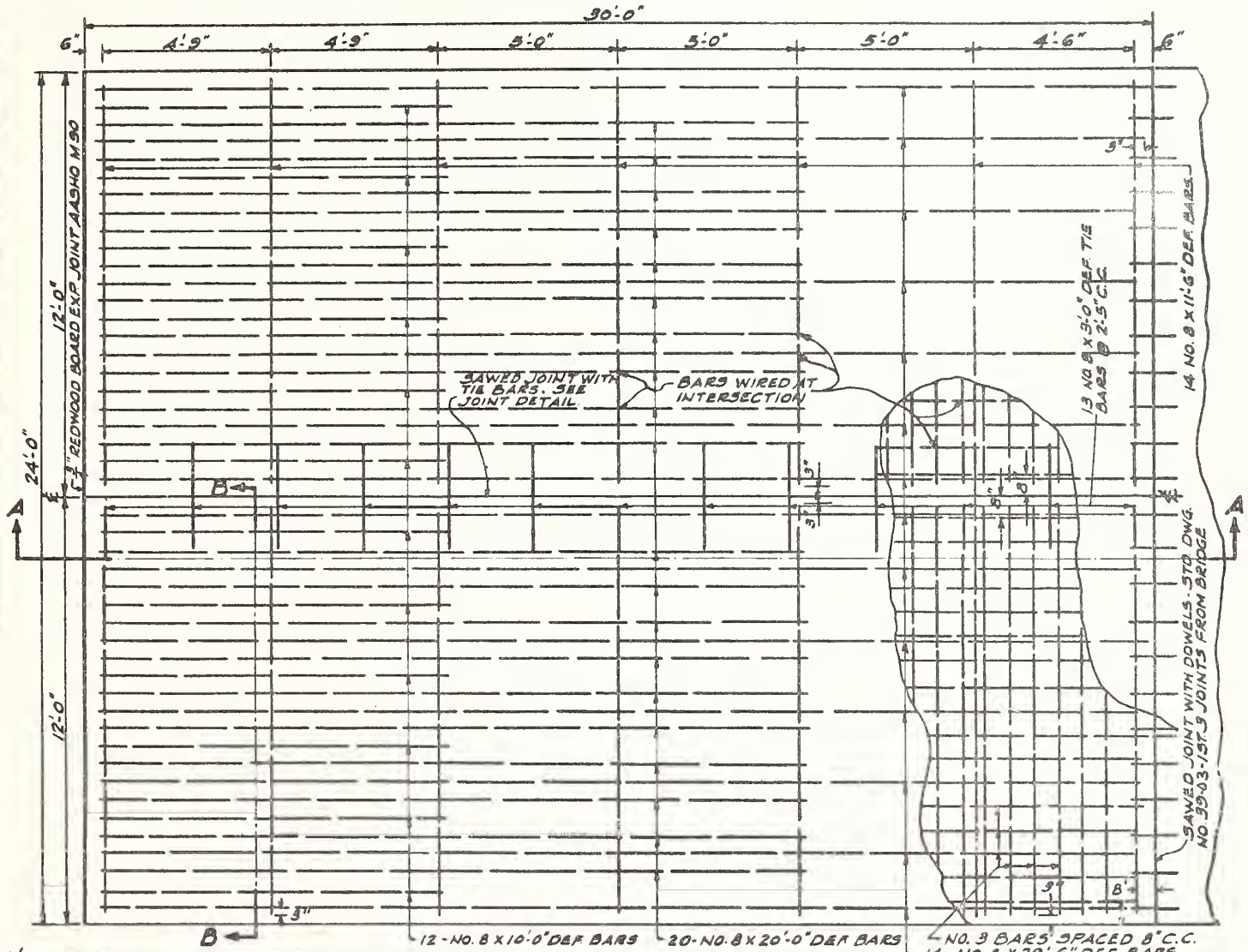
REVISED 5-1-63 10-25-68
EFFECTIVE 5-1-63 1-1-63

STANDARD DRAWING NO. 39-12

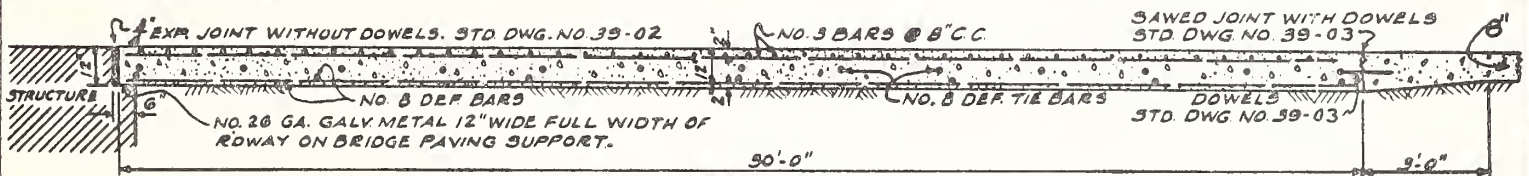
State Highway Commission
Helena, Montana

P.C. CONCRETE PAVEMENT BRIDGE APPROACH PANEL

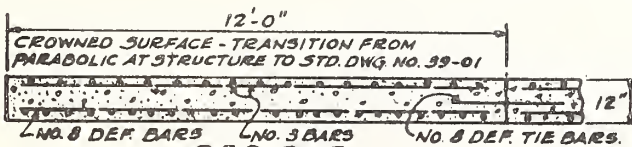
Approved
J. M. Smith 10-25-68
State Highway Engineer



NOTE: FOR SUPPORTS OF APPROACH PANELS AT STRUCTURES SEE PAVING NOTCH ON BRIDGE PLANS.



SEC. A-A.



SEC. B-B.



JOINT DETAIL
SEE STD. DWG. NO. 39-01 FOR CONSTRUCTION DETAILS.

THE CONCRETE SHALL BE STRUCK OFF TO AN ELEVATION 3" ABOVE SUBGRADE. THE NO. 8 STEEL BAR MAT SHALL BE PLACED THEREON IN ACCORDANCE WITH SEC. 47 OF THE STANDARD SPECIFICATIONS AND TAMPED TO THE DESIGNATED ELEVATION. THE NO. 3 STEEL BAR MAT SHALL BE PLACED TO THE DESIGNATED ELEVATION IN A SIMILAR MANNER AFTER THE SLAB HAS BEEN STRUCK OFF TO AN ELEVATION 10" ABOVE SUBGRADE.

STEEL BARS SHALL CONFORM TO "INTERMEDIATE GRADE" REINFORCING STEEL, A.A.S.H.O. M 31 & M 137 AND SEC. 47 OF THE STANDARD SPECIFICATIONS.

THE 3/4" EXPANSION JOINT MATERIAL AT THE BRIDGE END SHALL BE ANCHORED WITH NAILS.

THE COST OF THE STEEL BARS, THE NO. 26 GAGE GALVANIZED METAL, THE EXPANSION JOINT MATERIAL, THE JOINT SEALER, AND SUPPORTING DEVICES, SHALL BE INCLUDED IN THE UNIT PRICE BID PER SQUARE YARD OF P. C. CONCRETE PAVEMENT.

WHEN CALLED FOR, CONSTRUCT APPROACH PANEL TO BRIDGE OR STRUCTURE WIDTHS SHOWN ON THE PLANS, SYMMETRICAL ABOUT CENTERLINE.

THE BRIDGE APPROACH PANEL WILL BE INCLUDED IN THE QUANTITY OF CONCRETE PAVEMENT ON THE ROADWAY AND NO ADDITIONAL PAYMENT WILL BE ALLOWED BECAUSE OF REINFORCEMENT AND INCREASED THICKNESS.

STANDARD DRAWING NO. 39-14 (A)

Approved by:

Scale $\approx 1'' = 1'-0''$

TYPE I JOINT

STATE HIGHWAY COMMISSION
HELENA, MONTANA

STANDARD CONCRETE APPROACH SLAB TO STRUCTURES

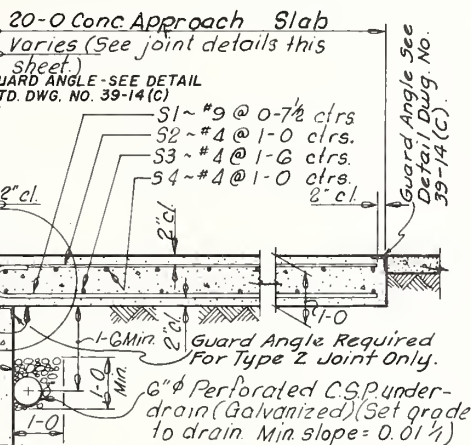
Approved by:
[Signature]
STATE HIGHWAY ENGINEER

For Details Of Type-1 Or Type-2
Joint Through Curb Section, See
Std. Dwg. No. 39-14 (A).

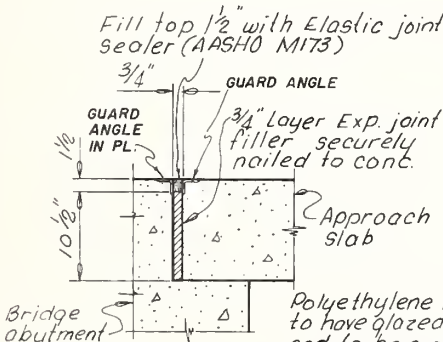
Type 1 joint for rigid abut.
Type 2 joint for moveable abut.
(For Type Required See General
Layout "On Bridge Plans.")

Detail "J"
(See Std. Dwg. No. 39-14(A)
18" wide layer of 30#
tar paper (Full length of
paving notch) (Lap over
9" on subgrade)

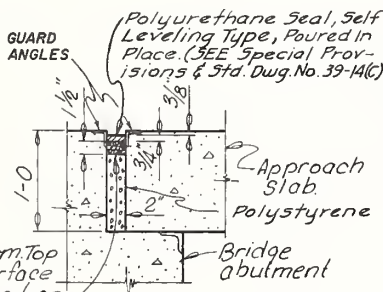
Type No. 2 Filter Material
(See Std. Spec. M100-12)
(Place full length of drain)



STANDARD APPROACH SLAB - TYPE B
(For use with asphalt pavement only)
Scale ~ 1/2" = 1'-0"

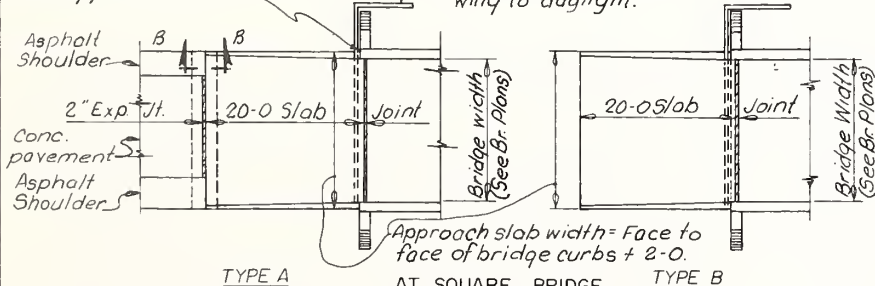


TYPE 1 JOINT
(For rigid abut.)
Scale ~ 1" = 1'-0"



TYPE 2 JOINT
(For moveable abut.)
Scale ~ 1" = 1'-0"

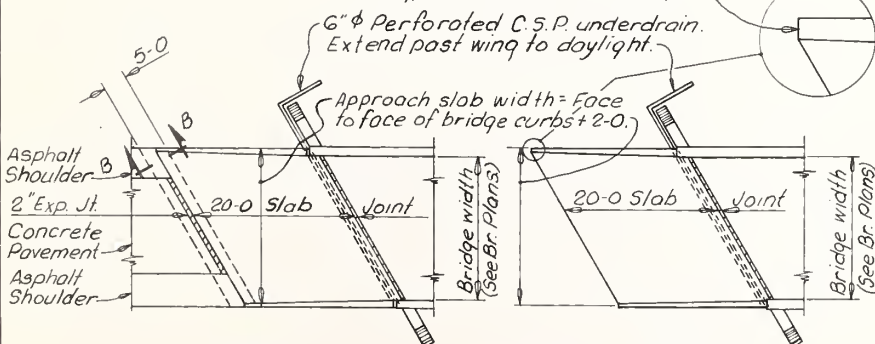
Joint At Curb End To Be The
Same As That Between Abut.
And Approach Slab.



TYPE A

AT SQUARE BRIDGE TYPE B

Curb end square to & Rdwy.
(Typ. both sides all slabs)



TYPE A

TYPE B

AT SKEWED BRIDGES

PLAN VIEW OF APPROACH SLABS

No Scale

Note ~ Slab & curb shall be curved or tapered
when necessary to match roadway.

NOTES

APPROACH SLAB Approach slab shall be constructed in accordance with Section 41 of the Standard Specification. The slab shall be finished as specified for bridge decks in Article 4104(K) 2 & 3. Concrete shall be either Class "AD" or Class "AP" at contractors option. **REINFORCING STEEL** Reinforcing steel shall be in accordance with Section 47 of the Standard Specifications except method of measurement and payment shall be as set forth below.

FOUNDATION The foundation for the approach slab and joint support slab shall consist of the subgrade and base constructed and compacted in accordance with Standard Plans and Specifications. Excavation for joint support slab shall be held to a minimum and all area excavated but not filled with concrete shall be backfilled with the same material that was taken from the excavation. All backfill shall be layer placed and compacted with mechanical tampers. The cost of all excavation necessary for the placement of approach slab and joint support slab shall be included in the unit price bid for "Concrete Approach Slab" as set forth below.

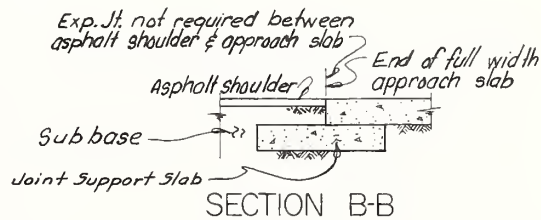
MEASUREMENT & PAYMENT Approach slabs shall be measured by area in square yards. The width and length for measurement shall be from out to out of completed slab. No additional area will be allowed for the joint support slab. The unit price bid per square yard for "Concrete Approach Slab" shall be full compensation for furnishing all materials, equipment, tools and labor necessary to complete the work, including the joint support slab and linseed treatment.

SEALS For type and method of application of polyurethane seals see Special Provisions.

SEALANT Polyurethane sealants shall meet Federal Specification SS-S-00195a-(I)(CE) or SSS-S-00200 C Sealing Compound: Two-component Elastomeric Polymer Type, Cold-Applied, Concrete Paving Joints and shall be one of the following or approved equal:

1. PRC 3105
Products Research and Chemical Corp.
Burbank, California
2. U-Seal 3201
Edoco Technical Products, Inc.
Long Beach, California
3. Sikaflex T-68
Sika Chemical Corp.
Lynhurst, New Jersey
4. Meta-Seal 220
American Metaseal Co.
Detroit, Michigan

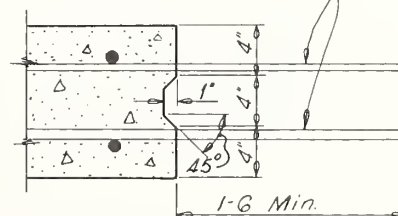
PROTECTIVE COATING Approach Slab And Curb
shall be given a protective coating of Boiled
Linseed Oil. See Standard Specifications.



SECTION B-B

Note Traffic shall not be permitted on new approach slab for at least 14 days after concrete has been placed. Traffic shall not be allowed to drive within 5 feet of the construction joint and shall be restricted to a speed of not more than 5 m.p.h. for at least 48 hours after the concrete in adjacent slab has been placed.

Transverse slab steel



LONGITUDINAL CONSTRUCTION

JOINT DETAIL

Scale ~ 1/2" = 1'-0"

(Use only when shown on the plans or
approved by the engineer.)

REVISED		7-1-71
EFFECTIVE	4-15-71	8-1-71

STANDARD DWG. NO. 39-14 (C)

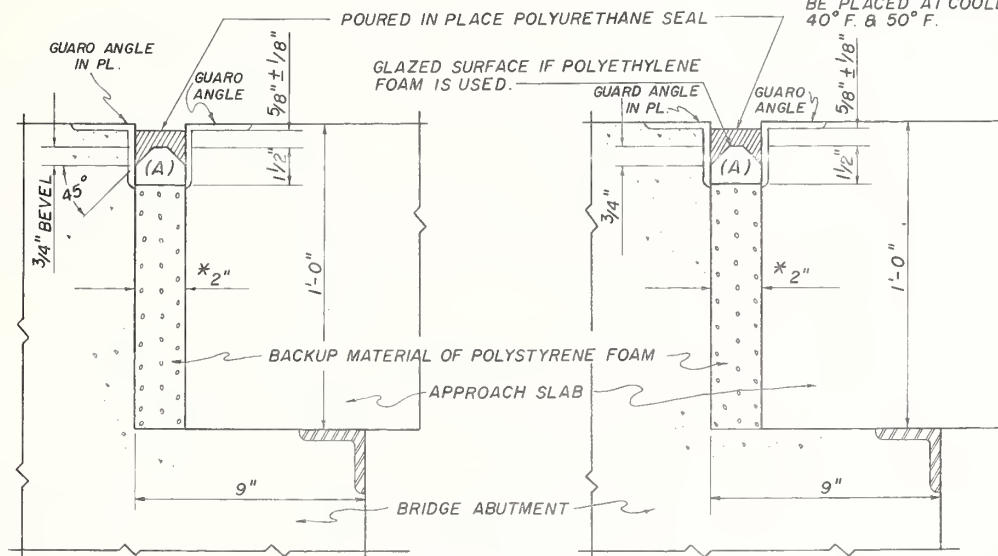
STATE HIGHWAY COMMISSION
HELENA, MONTANA

STANDARD CONCRETE APPROACH SLAB TO STRUCTURES

APPROVED:
[Signature] 3.10.71
STATE HIGHWAY ENGINEER

NOTE: BLOCKS (A) MAY BE CUT FROM POLYSTYRENE OR BE PREFORMED POLYETHYLENE FOAM TO EITHER OF THE SHAPES SHOWN.

NOTE: THE AMBIENT TEMPERATURE DURING THE PLACING OF THE SEAL SHALL NOT BE GREATER THAN 70°F AND IF PRACTICABLE IT SHALL BE PLACED AT COOLER TEMPERATURES, PREFERABLY BETWEEN 40°F & 50°F.



SEAL DETAIL
SCALE: 3"=1'-0"

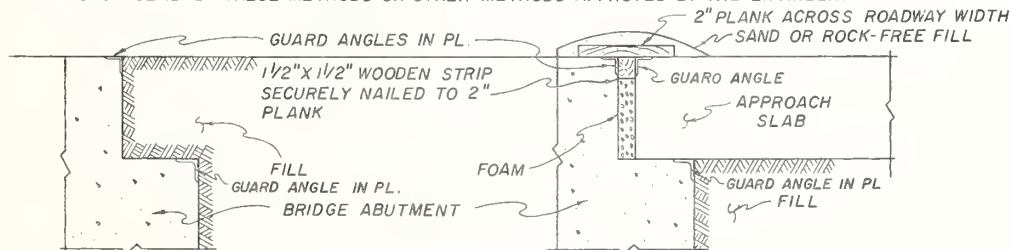
* 2" JOINT OPENING AT 60°F ADJUST JOINT FOR TEMPERATURE AT TIME OF PLACING APPROACH SLAB CONC.

NOTE: IF THE POLYSTYRENE BLOCK (A) IS USED, PROVIDE A BOND BREAKER MATERIAL BETWEEN (A) AND THE POURED SEALANT.

NOTE: IF THE POURED SEALANT IS TO BE PLACED AGAINST A METAL SURFACE THE PROPER PRIMER MUST BE APPLIED.

NOTE: IF THE CONTRACTOR INTENDS TO USE CONSTRUCTION EQUIPMENT ON THE BRIDGE DECK PRIOR TO THE PLACEMENT OF THE APPROACH SLAB, OR PRIOR TO THE PLACEMENT OF THE JOINT SEAL, HE SHALL PREVENT DAMAGE TO THE EDGES OF THE CONCRETE BRIDGE DECK AND APPROACH SLAB BY THESE METHODS OR OTHER METHODS APPROVED BY THE ENGINEER.

GUARD ANGLE MAY BE FURNISHED IN TWO PIECES WITH END ANCHOR BARS 6" MAX. FROM EACH END.



EDGE PROTECTION
SCALE: 1"=1'-0"

L 2 1/2" X 2 1/2" X 3/8" FABRICATE TO CROWN OF ROADWAY

DRILL 5/16" Ø HOLES AT 1'-0" CTR'S. FOR BOLTING TO FORMS.

2" X 5/16" X 9" ANCHOR BARS AT 1'-0" ALT. CTR'S (REQ'D. PER END BENT)

GUARD ANGLE DETAIL
SCALE: 1 1/2"=1'-0"

MIXING GREAT CARE SHOULD BE USED IN MIXING

THE SEALANT IS NORMALLY A TWO COMPONENT SYSTEM WITH SPECIFIC MIXING INSTRUCTIONS SUPPLIED BY THE MANUFACTURER. GENERALLY, THE MIX RPM MUST BE REDUCED TO LOW SPEED TO AVOID EXCESSIVE AIR ENTRAPMENT. APPLICATION MAY BE MADE BY GUN OR POURING.

SOME TYPES OF SEALANT ARE PROVIDED IN TWO GRADES; (1) SELF LEVELING AND (2) NON SAG. THERE IS GENERALLY NO DIFFERENCE IN COST AND DEPEND-ING UPON THE RECOMMENDATIONS OF THE MANUFACTURER ONE GRADE IS USED IN THE HORIZONTAL OR SLAB SECTION OF THE JOINT AND ANOTHER GRADE MAY BE REQUIRED FOR THE VERTICAL OR CURB SECTION OF THE JOINT.

JOINT PREPARATION THE VERTICAL FACES OF THE HORIZONTAL SHALL BE CLEANED BY SANDBLASTING UNTIL FREE OF ALL BONDED JOINT FORM MATERIAL, DUST, OIL, CURING COMPOUND, LAITANCE AND OTHER FOREIGN MATTER. FOLLOWING SANDBLASTING, REMOVE ALL LOOSE MATERIAL FROM THE JOINT WITH OIL FREE COMPRESSED AIR AT APPROXIMATELY 120 CFM AND A NOZZLE PRESSURE OF APPROXIMATELY 90 PSI. IF THE SEAL IS TO BE PLACED AGAINST METAL, SUCH AS A GUARD ANGLE, THE METAL SURFACE SHALL BE DRY, CLEAN, FREE OF CORROSION, MILL SCALE, OIL, TAR, PAINT OR OTHER CONTAMINATION. THE BOND SURFACE SHOULD BE SANDBLASTED TO WHITE METAL. THE JOINT SHOULD AGAIN BE BLOWN OUT BY MEANS OF DRY, OIL FREE COMPRESSED AIR AFTER THE COMPLETION OF ALL CLEANING OPERATIONS. PLACEMENT OF POLYSTYRENE FILLERS AND BLOCK A AND JUST PRIOR TO PRIMING (WHEN REQUIRED).

PRIMING MOST SEALANTS REQUIRE A PRIMER. AFTER CLEANING OPERATIONS HAVE BEEN COMPLETED AND THE BACKUP MATERIAL IS IN PLACE THE PRIMER IS APPLIED. PRIMERS ARE SUPPLIED FOR VARIOUS CONDITIONS. THEY ARE AVAILABLE FOR APPLICATION TO CONCRETE OR METAL SURFACES AND FOR TEMPERATURES OF 15° TO 80°, AND FOR TEMPERATURES ABOVE 80°. IT IS OF MOST IMPORTANCE THAT THE PROPER PRIMER IS USED AND THAT ITS APPLICATION IS TO THE VERTICAL SURFACES ONLY. PRIMING OF THE BACKUP MATERIAL OR THE TOP SURFACES OF BLOCK A SHOULD BE AVOIDED AS MUCH AS POSSIBLE.

A CAREFUL INSPECTION SHOULD BE MADE AFTER PRIMER APPLICATION TO INSURE COMPLETE COVERAGE OF THE SIDE FACES. IF "MISSED SPOTS" OCCUR, RE-PRIME.

THE SEALANT SHOULD NOT BE PLACED UNTIL THE PRIMER IS COMPLETELY DRY. IF CONDITIONS PREVENT PLACEMENT OF SEALANT FOR MORE THAN SIX HOURS AFTER PRIMING THE SURFACE SHOULD BE REPRIMED.

A BOND BREAKER MATERIAL MAY BE REQUIRED BETWEEN BLOCK A AND THE SEALANT AS NOTED ON THE ATTACHED SKETCH.

SEALING THE MOST IMPORTANT REQUIREMENT OF PLACING THE SEALANT IS TO INSURE THAT THE MAXIMUM THICKNESS ABOVE BLOCK A DOES NOT EXCEED 3/4" AT THE CENTER OF THE JOINT. BE ESPECIALLY CERTAIN TO MAINTAIN THE 5/8" MEAN DIMENSION AS SHOWN ON THE ATTACHED DETAIL.

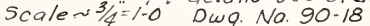
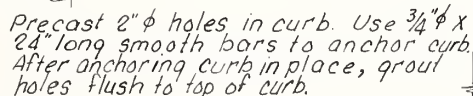
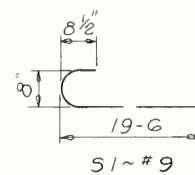
SINCE THE VARIOUS ACCEPTABLE PRODUCTS USED AS SEAL MATERIAL VARY SOMEWHAT WITH RESPECT TO APPLICATION TEMPERATURES, CURE REQUIREMENTS, METHOD OF APPLICATION, ETC., ONLY THE VERY IMPORTANT KNOWN PROBLEM AREAS ARE MENTIONED HERE.

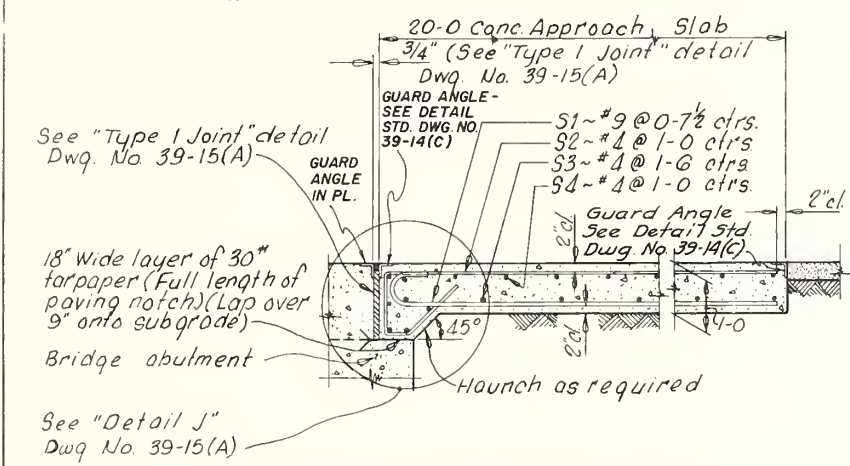
LINSEED TREATMENT IN THE EVENT THE LINSEED TREATMENT IS APPLIED PRIOR TO INSTALLATION OF THE APP SLAB SEAL, EXTREME CARE SHALL BE TAKEN TO INSURE THAT THE TREATMENT DOES NOT COME INTO CONTACT WITH THE APPROACH SLAB-SEAL CONTACT SURFACES.

SINCE THE LINSEED TREATMENT PENETRATES CONCRETE SURFACES TO A CONSIDERABLE DEPTH, A FAILURE OF BOND BETWEEN THE APPROACH SLAB SEAL AND ADJOINING CONC. SURFACES IS NEARLY CERTAIN UNLESS PROTECTIVE MEASURES ARE TAKEN TO PROTECT THE EXPOSED JOINT SURFACE FROM OVERSPRAY.

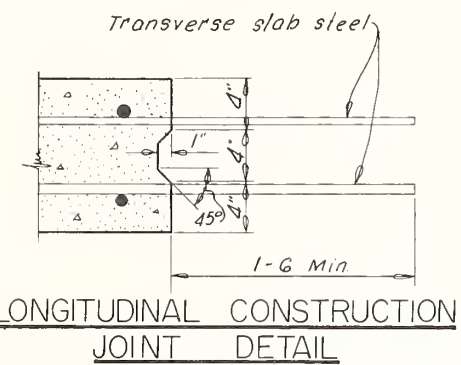
STANDARD DRAWING NO. 39-15(A)

Approved by: *Samuel Phillips* 4/2/20
STATE HIGHWAY ENGINEER

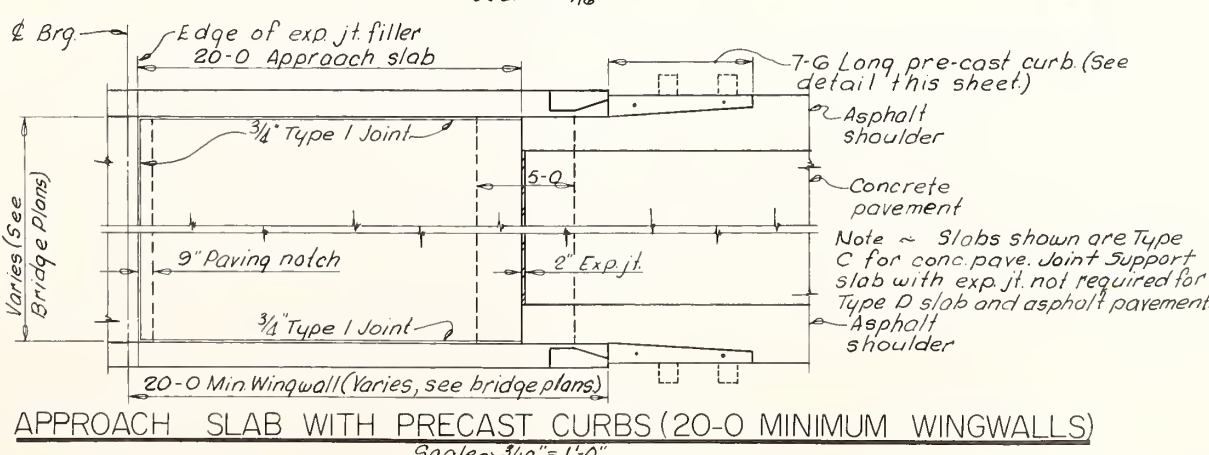
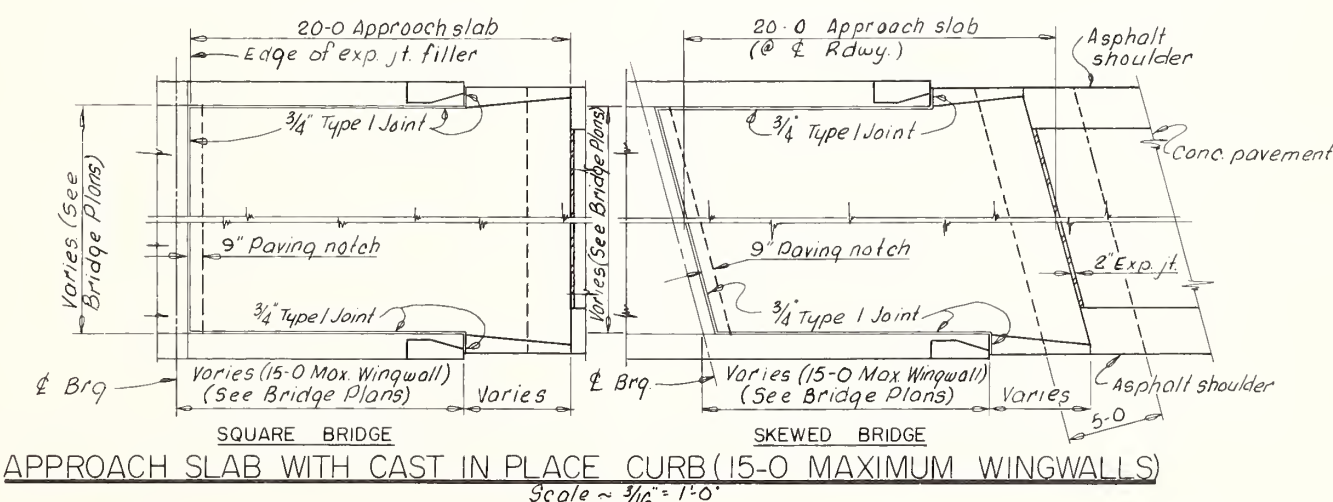




STANDARD APPROACH SLAB - TYPE D
(For use with asphalt pavement only)
Scale ~ 1/2" = 1'-0"



(Use only when shown on the plans or
approved by the engineer.)



REVISED 10-21-68
EFFECTIVE 1-1-59 1-1-69

STANDARD DRAWING NO. 41-01

State Highway Commission
Helena, Montana

BOX CULVERT DATA -- REFERENCE

Approved
James A. Smith 10-25-68
State Highway Engineer

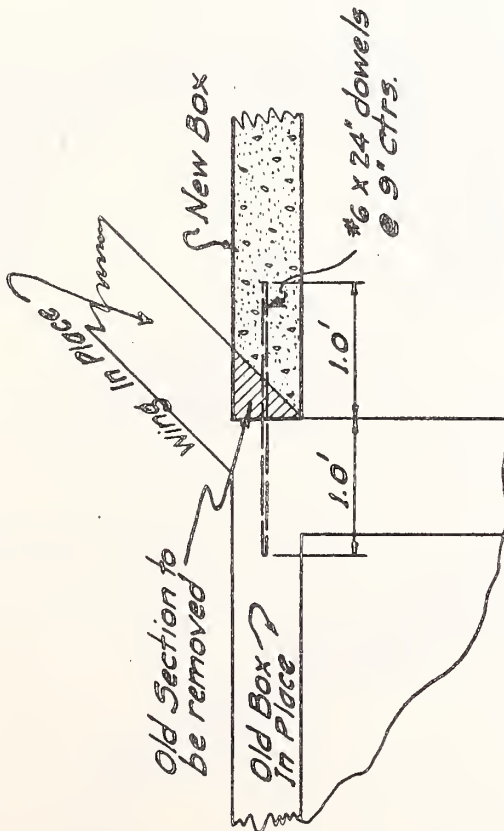
STD. DWG. NO'S. { 41-06
41-07
41-08

REINF. CONC. BOX CULV.

FOR DETAILED PRINTS
WRITE OFFICE ENGINEER
STATE HIGHWAY COMMISSION
HELENA, MONTANA.
(ORIGINALS FILED IN BRIDGE DEPT.)

STD. DWG. NO. 41-05

DETAIL FOR LENGTHENING EXISTING RE-CONC. BOX CULVERT.



NOTE:- Doweling as shown to be used where top, sides and bottom of new box join that of the old. Curb to be removed, if necessary. Dowels to be included in the unit price bid for reinf. steel.

REVISED	5-1-63	11-1-68	9-12-69			
EFFECTIVE	5-1-63	1-1-69	1-1-70			

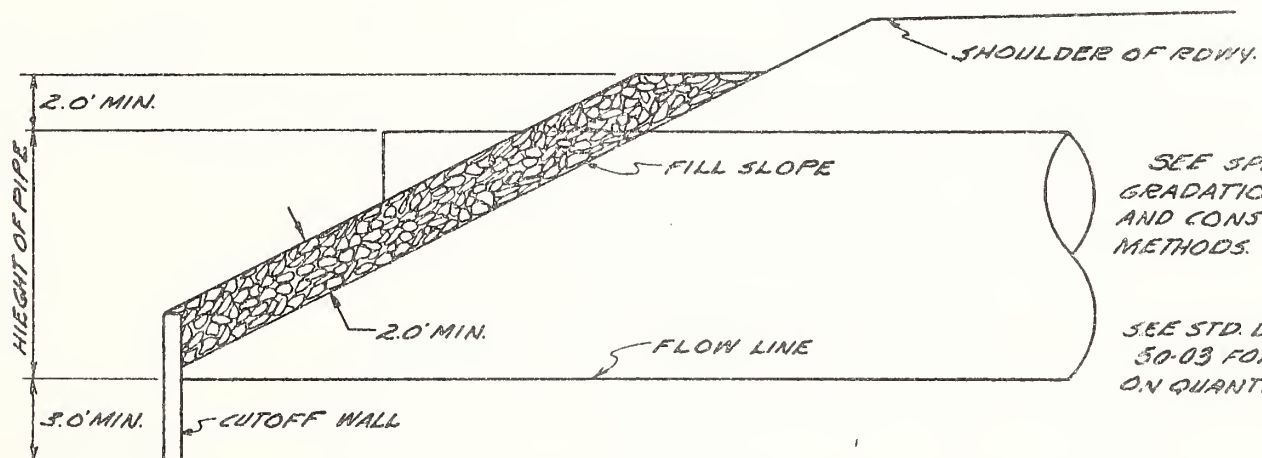
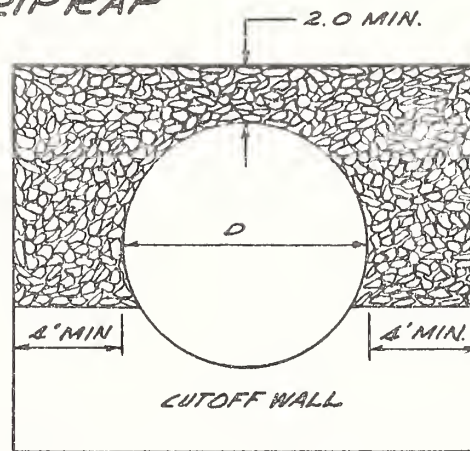
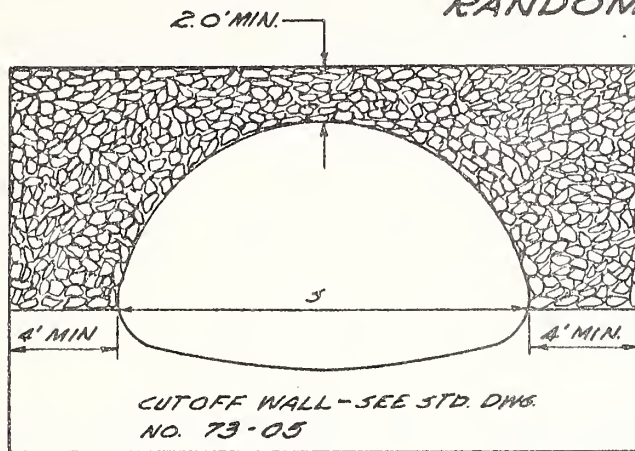
STANDARD DRAWING NO. 50-01

State Highway Commission
Helena, Montana

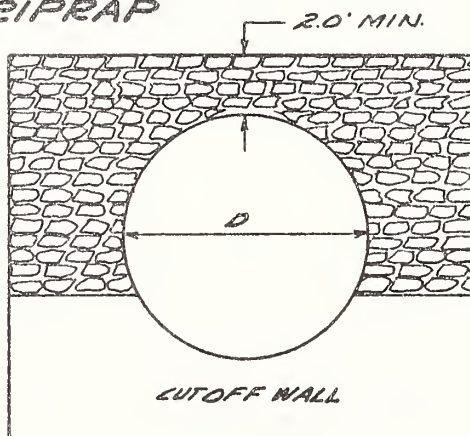
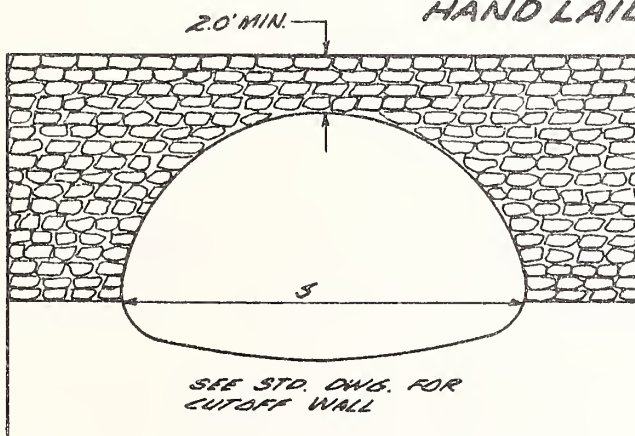
CULVERT RIPRAP

Approved
J. W. Sullivan 10-24-68
State Highway Engineer

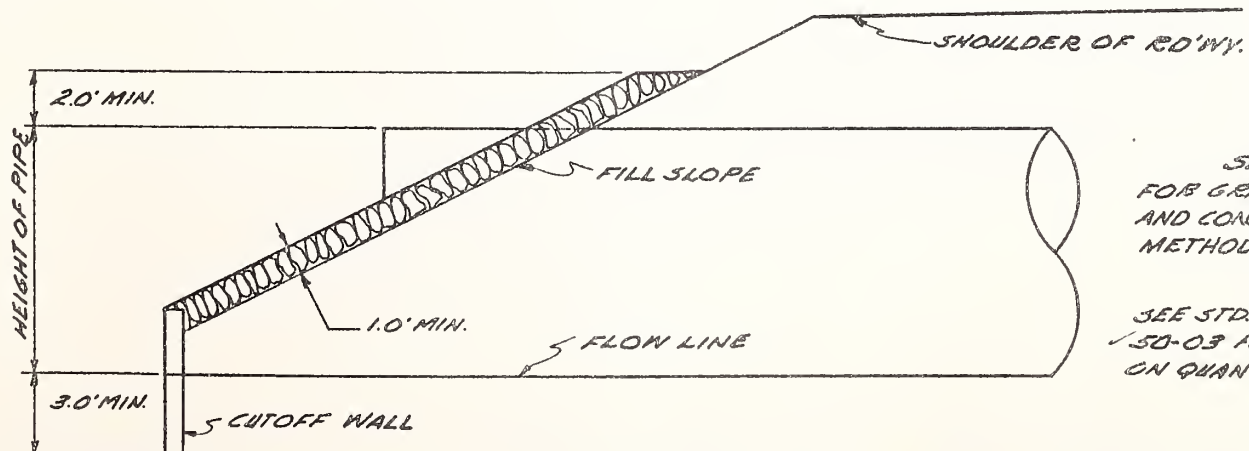
RANDOM RIPRAP



HAND LAID RIPRAP



ENDS OF RIPRAP WALLS SHALL BE KEVED INTO THE EMBANKMENT SLOPES A MIN. OF 2' FROM OUTER FACE OF THE RIPRAP FOR THE FULL HEIGHT OF THE RIPRAP WALL.

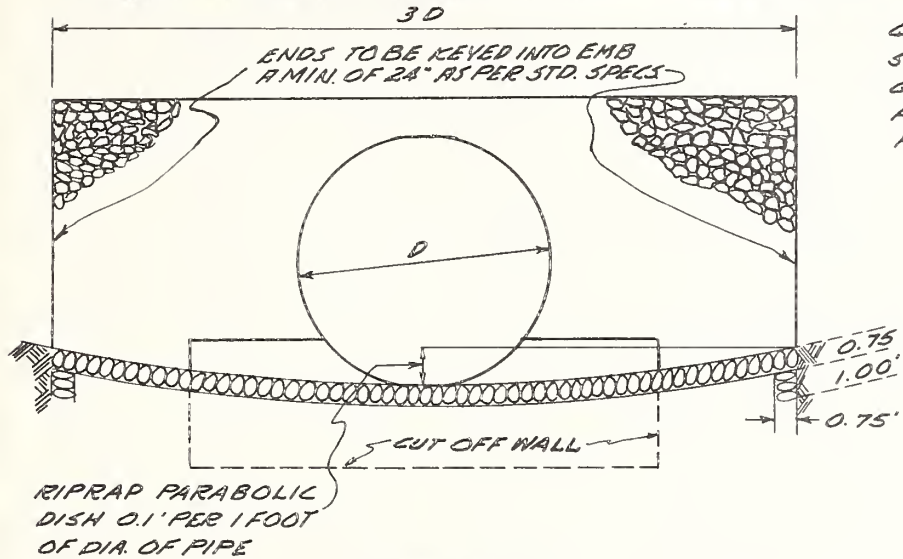


State Highway Commission
Helena, Montana

GROUTED RIPRAP

Approved
James M. Phillips 10-24-68
State Highway Engineer

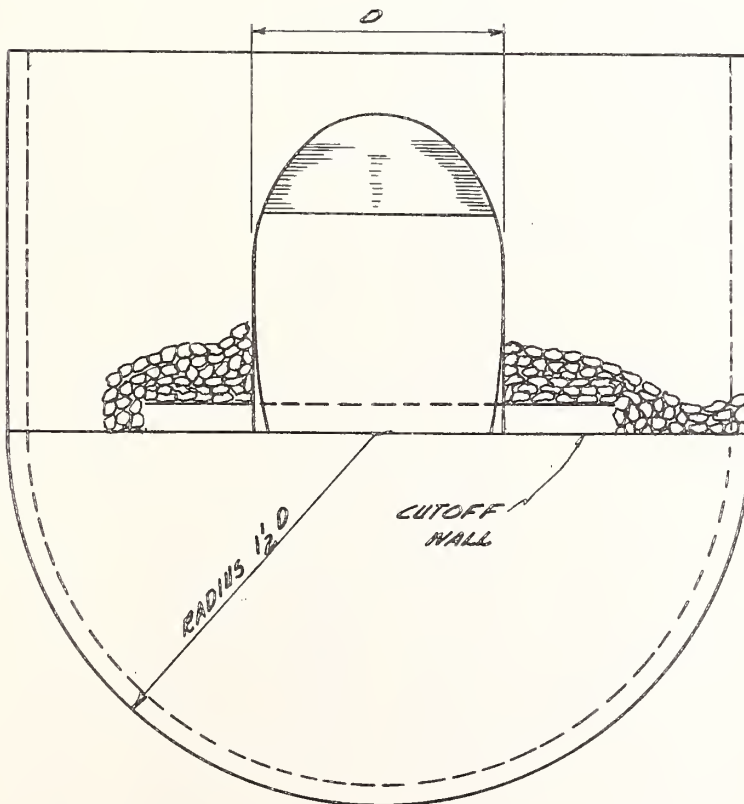
GROUTED RIPRAP HEADWALLS FOR STRUCTURAL PLATE PIPE CULVERTS



ELEVATION

SEE STD. DWG.
FOR CUTOFF WALL

SEE STD. DWG.
FOR BACKFILL MATERIAL



PLAN

QUANTITIES ON STD.
SHEET NO. 50-03 FOR
GROUTED RIPRAP
FIGURED TO TOP OF
PIPE ONLY

TOPOF RIPRAP 2' MIN. ABOVE TOP
OF PIPE OR TO SUBGRADE SHOULDER.

SLOPE AS
PER PLANS

SEE STD. DWG.
NO. 57-03 FOR
QUANTITIES

INCREASE
AS NEEDED

WHERE RIPRAP IS NOT
CALLED FOR ON PLANS,
PIPE MUST EXTEND A
MIN. OF 2' BEYOND SLOPE
TO PROVIDE FOR FUTURE
RIPRAP IF REQUIRED

MULTIPLE PIPES
WHERE MULTIPLE LINE OF PIPES
ARE INSTALLED, THE ADJACENT
SIDES SHALL BE A MIN. OF 4
FT. AND A MAX. OF 6 FT.

0.75' KEY
1.00' KEY

STATE HIGHWAY COMMISSION
HELENA, MONTANA

RIPRAP QUANTITIES

APPROVED
J. M. Sullivan 10-24-68
STATE HIGHWAY ENGINEER

STRUCTURAL PLATE PIPE

DIAMETER OF PIPE	C.Y. RANDOM RIPRAP MATL. REQD. FOR 2.0' THICKNESS		
	1 1/2:1 BEV.	2:1 BEV.	2 1/2:1 BEV.
60	10.9	12.5	14.9
66	11.5	13.0	15.8
72	12.0	14.7	17.2
78	12.6	14.4	18.1
84	13.1	15.9	19.6
90	13.7	16.5	20.5
96	14.9	17.3	22.1
102	15.6	18.3	23.0
108	16.1	18.8	23.8
114	16.9	21.8	24.7
120	17.4	22.7	27.2
126	18.0	23.3	28.2
132	20.5	24.2	28.9
144	21.7	24.9	31.6
156	23.0	28.1	33.5
168	25.1	28.9	36.3
180	25.8	31.4	39.0

RANDOM (ONE END)

STRUCT. PLATE PIPE ARCH

SPAN	RISE	C.Y. RANDOM RIPRAP MATL. REQD. FOR 2.0' THICKNESS		
		1½:1 BEV.	2:1 BEV.	2½:1 BEV.
		18" CORNER PLATES		
6'1"	4'7"	8.9	10.7	12.8
6'9"	4'11"	9.5	11.5	13.7
7'3"	5'3"	10.6	12.9	15.3
7'11"	5'7"	11.2	13.6	16.2
8'7"	5'11"	11.8	14.3	17.1
9'4"	6'3"	12.4	15.1	18.0
9'9"	6'7"	13.4	16.3	19.5
10'8"	6'11"	13.9	16.8	20.1
11'5"	7'3"	14.6	17.7	21.1
11'10"	7'7"	15.8	19.2	22.9
12'6"	7'11"	16.5	20.1	24.0
12'10"	8'4"	17.4	21.1	25.2
		31" CORNER PLATES		
14'0"	9'8"	18.9	23.0	27.5
15'4"	10'4"	20.2	24.6	29.5
16'6"	11'0"	22.3	27.1	32.4
17'11"	11'8"	24.2	29.4	35.2
19'3"	12'4"	25.6	31.2	37.4
20'5"	13'0"	27.4	33.4	40.0

STRUCTURAL PLATE PIPE

DIAMETER OF PIPE	C.Y. HAND LAID RIPRAP MATL. REQD. FOR 1.0' THICKNESS		
	1 1/2:1 BEV.	2:1 BEV.	2 1/2:1 BEV.
60	6.9	8.1	9.8
66	7.3	8.4	10.3
72	7.5	9.5	11.3
78	7.9	9.2	11.8
84	8.2	10.2	12.8
90	8.6	10.6	13.3
96	9.5	11.1	14.3
102	9.8	11.6	14.9
108	10.0	11.9	15.3
114	10.5	14.0	15.9
120	10.8	14.5	17.5
126	11.1	14.8	18.1
132	12.8	15.3	18.5
144	13.5	15.6	20.2
156	14.2	17.7	21.2
168	15.6	18.1	22.9
180	15.8	19.6	24.7

HAND LAID (ONE END)

STRUCT. PLATE PIPE ARCH

C.Y. HANDLAID RIPRAP MATL. REQD. FOR 1.0' THICKNESS				
		1½":1 BEV.	2":1 BEV.	2½":1 BEV.
18" CORNER PLATES				
		5.2	6.6	8.0
		5.6	7.0	8.5
		6.3	7.9	9.6
		6.6	8.3	10.0
		7.0	8.7	10.5
		7.3	9.1	11.0
		7.9	9.9	12.0
		8.0	10.0	12.1
		8.4	10.5	12.7
		9.2	11.5	13.9
		9.6	12.0	14.5
		10.2	12.7	15.3
31" CORNER PLATES				
		11.0	13.7	16.5
		11.7	14.6	17.6
		12.8	16.1	19.4
		13.9	17.3	20.9
		14.7	18.3	22.1
		15.7	19.6	23.6

STRUCTURAL PLATE PIPE

DIAMETER OF PIPE	*SQ. YDS. GROUTED RIPRAP MATL. QUANTITIES COMPUTED TO TOP OF PIPE		
	1 1/2:1 BEV.	2:1 BEV.	2 1/2:1 BEV.
60	30.1	32.3	36.7
66	35.8	38.0	43.9
72	41.4	48.4	53.8
78	48.3	51.8	62.4
84	55.0	63.2	74.2
90	62.9	71.2	84.2
96	73.5	80.9	97.7
102	82.8	91.6	109.2
108	91.4	100.9	120.5
114	101.6	123.2	133.3
120	111.5	135.6	154.4
126	123.0	147.3	168.9
132	143.5	160.9	182.9
144	168.2	184.0	218.8
156	195.2	223.9	252.7
168	228.3	251.3	294.8
180	256.3	291.6	340.0

*KEYS NOT INCLUDED
GROUTED (2 HDWLS. & APRON FOR OUTLET)

STRUCT. PLATE PIPE ARCH

SPAN	RISE	*SQ. YDS. GROUTED RIPRAP MATL. REQD.		
		1½:1 BEV.	2:1 BEV.	2½:1 BEV.
		18" CORNER PLATES		
6'1"	4'7"	29.5	32.5	35.8
6'9"	4'11"	36.3	40.0	43.9
7'3"	5'3"	44.7	49.8	55.1
7'11"	5'7"	52.8	58.6	64.8
8'7"	5'11"	61.5	68.3	75.3
9'4"	6'3"	71.7	79.4	87.4
9'9"	6'7"	81.3	90.5	100.2
10'8"	6'11"	93.6	103.3	113.6
11'5"	7'3"	105.9	117.0	128.5
11'10"	7'7"	118.2	131.2	145.0
12'6"	7'11"	131.6	146.0	161.1
12'10"	8'4"	142.2	158.7	176.0
		31" CORNER PLATES		
14'0"	9'8"	172.1	191.4	211.9
15'4"	10'4"	203.2	225.6	249.2
16'6"	11'0"	238.0	265.0	293.5
17'11"	11'8"	278.6	310.0	343.0
19'3"	12'4"	317.9	353.0	390.2
20'5"	13'0"	359.1	399.4	441.8

REVISED 5-1-63 11-1-68
EFFECTIVE 5-1-63 1-1-69

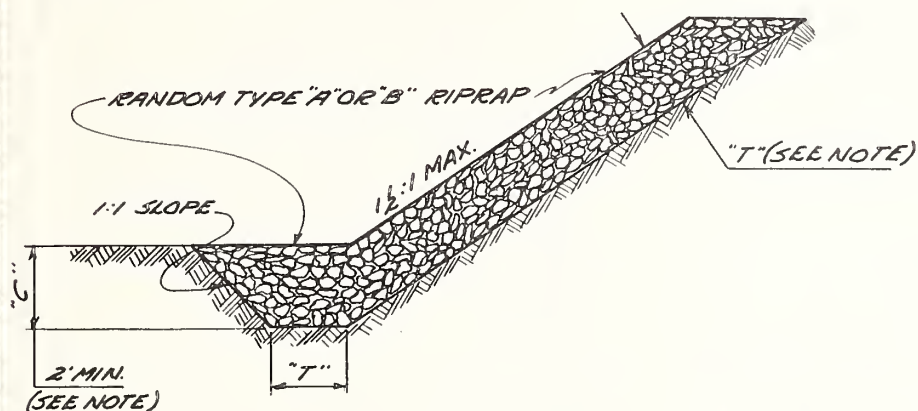
STANDARD DRAWING NO. 50-04

State Highway Commission
Helena, Montana

EMBANKMENT PROTECTION

Approved

James H. Phillips 10-24-68
State Highway Engineer

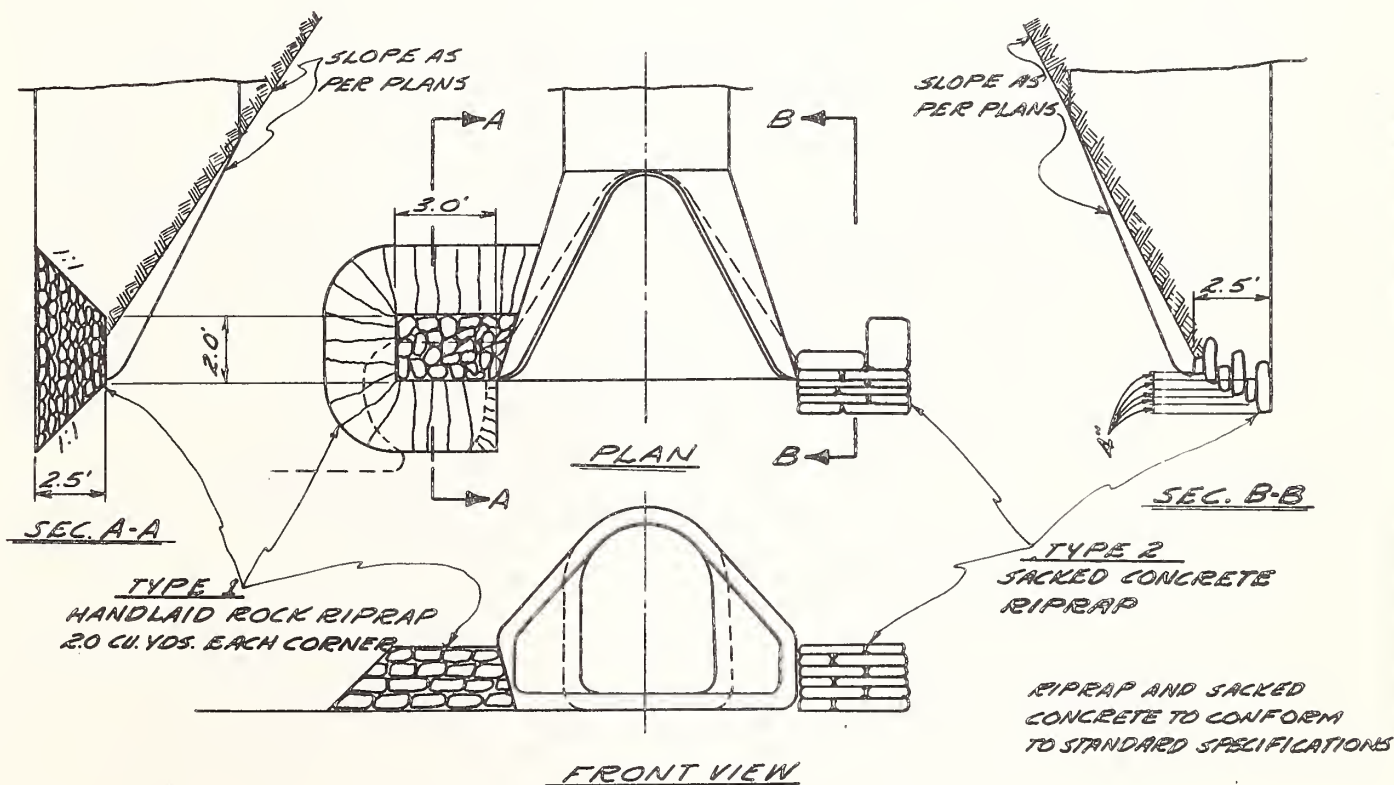


NOTE:

"T" SHALL BE 1.5' MIN. UNLESS OTHERWISE SPECIFIED ON PLANS.

"C" SHALL BE 2' 0" MIN. UNLESS OTHERWISE SPECIFIED FOR MORE PROTECTION DUE TO SCOUR.

EMBANKMENT PROTECTION



TOE PROTECTION FOR CONCRETE UNDERPASS

STD. DWG. FOR PREFABRICATED
CONCRETE UNDERPASS

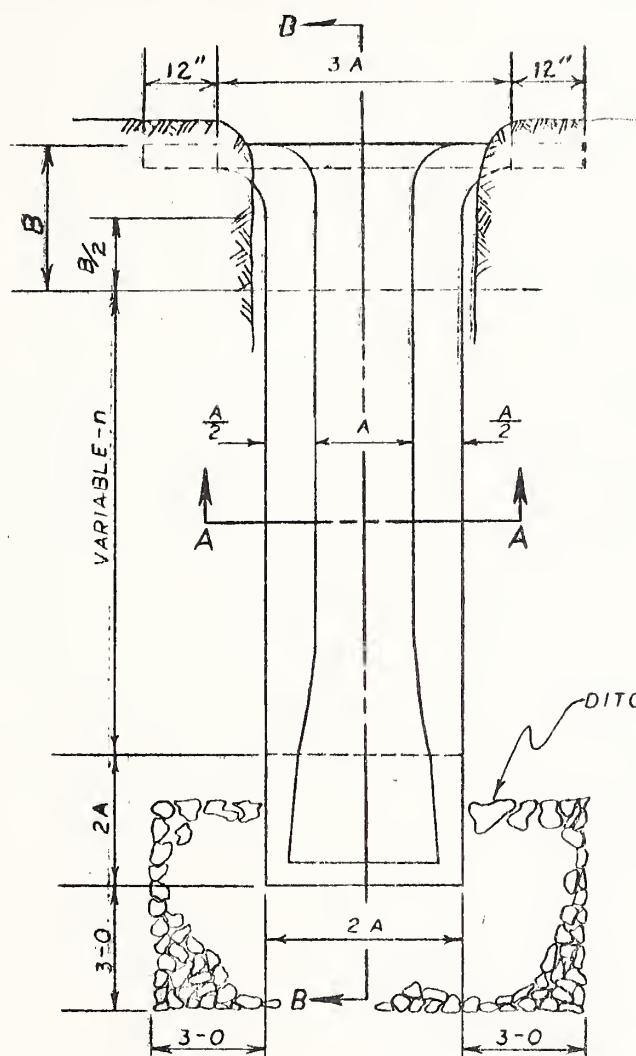
Revised 6-1-62 2-6-70
Effective 7-1-62 4-1-70

STANDARD DRAWING NO. 50-05

STATE HIGHWAY
COMMISSION
HELENA, MONTANA

CONCRETE DRAINAGE CHUTE

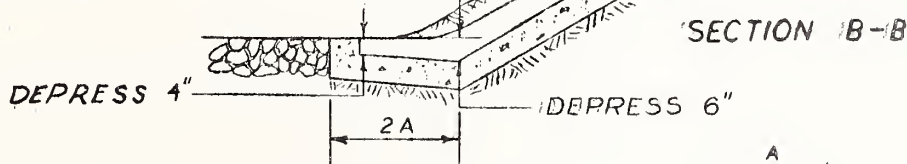
Approved
5/21/69
State Highway Engineer



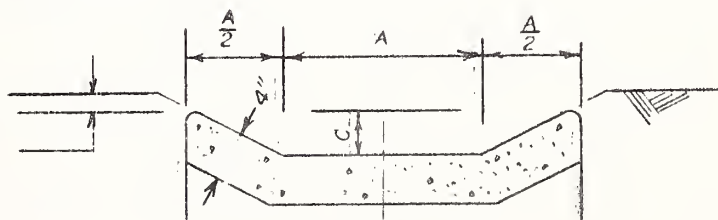
DITCH GRADE

WHEN CONSTRUCTED
ON FILL SLOPE USE
6"x6" WIRE MESH, 6 ga.
DELETE ON CUT SLOPE.

BANK PROTECTION
SEE NOTES



DEPRESS 6"



SECTION A-A

DIMENSIONS			QUANTITIES
A	B	C	CONCRETE CU. YD.
2-0	4-0	0-4	0.7 cu. yd. + nx.051 cu. yd./lin. ft.
2-0	4-0	1-0	0.9 cu. yd. + nx.056 cu. yd./lin. ft.
4-0	8-0	1-0	2.2 cu. yd. + nx.105 cu. yd./lin. ft.
4-0	8-0	1-6	2.3 cu. yd. + nx.111 cu. yd./lin. ft.

**Excavation and bank protection to be included in the unit price bid for concrete

NOTES

SPECIFICATIONS: Montana State Highway Commission Standard Specifications for Road and Bridge Construction, adopted March 1, 1968 and any amendments thereto, and special provisions shall govern unless otherwise noted.

CONCRETE: All concrete shall be class AC-DC unless otherwise noted. Concrete shall conform to section 40 of the specifications. Concrete may be pneumatically applied.

*BANK PROTECTION: Bank protection shall be type 4 and shall conform to subsection 50.30 of the specifications. Thickness shall be 12".

INLET CONDITIONS: The inlet is to be depressed below the natural drainage basin to prevent flow from side channeling over the slope before reaching the chute.

TOP OF CUT
OR FILL
SLOPE

WHEN CONSTRUCTED
ON FILL SLOPE USE
6"x6" WIRE MESH, 6 ga.
DELETE ON CUT SLOPE.

100-100000-100000
 100-100000-100000
 100-100000-100000
 100-100000-100000



100-100000-100000
 100-100000-100000

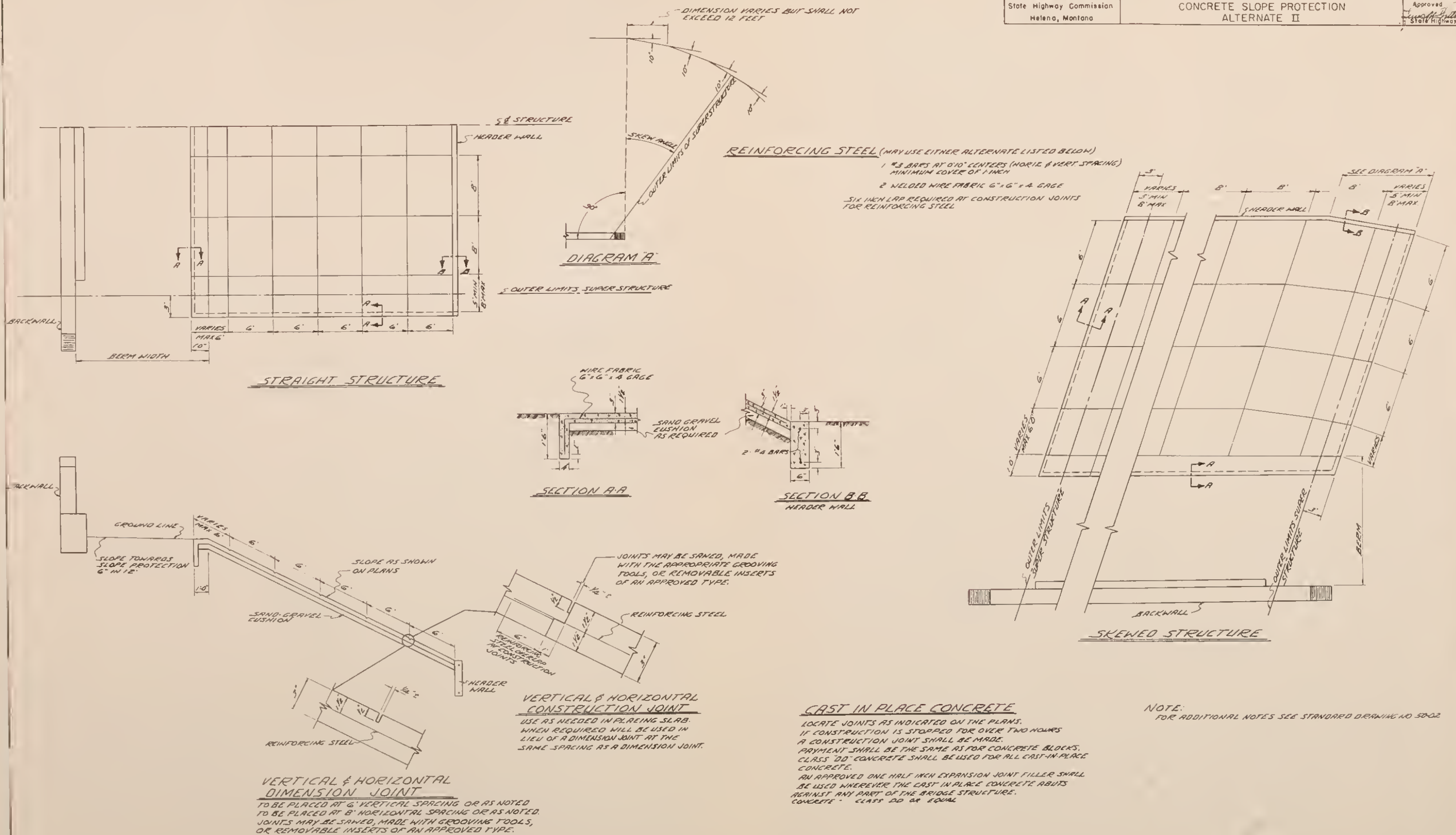
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STANDARD DRAWING NO. 50-21-A

APPROVED
[Signature]
 STATE HIGHWAY ENGINEER



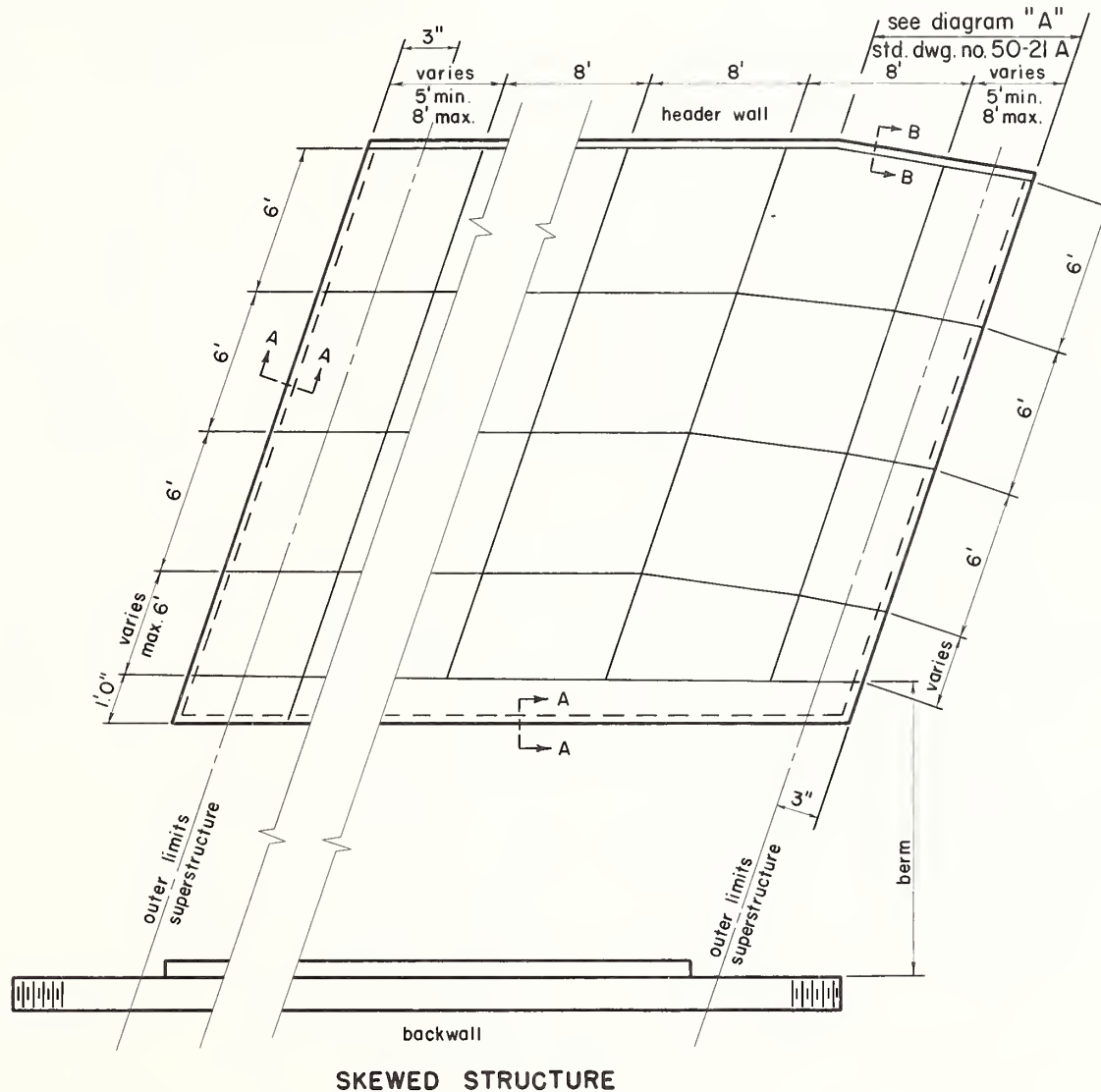
REVISED		7-9-71
EFFECTIVE	1-1-71	8-1-71

STANDARD DRAWING NO. 50-21-B

STATE HIGHWAY COMMISSION
HELENA, MONTANA

CONCRETE SLOPE PROTECTION ALTERNATE II (SEE 50-21 A)

APPROVED
James H. Cullum
STATE HIGHWAY ENGINEER



SKewed STRUCTURE

NOTE:
For additional notes see Standard Drawing No. 50-21 A

CAST IN PLACE CONCRETE

Locate joints as indicated on the plans. If construction is stopped for over two hours a construction joint shall be made. Payment shall be the same as for concrete blocks. Class "DD" concrete shall be used for all cast-in-place concrete.

An approved one half inch expansion joint filler shall be used wherever the cast in place concrete abuts against any part of the bridge structure concrete - class "DD" or equal.

REINFORCING STEEL

(may use either alternate listed below)

1. 3 bars at 0'10" centers (horiz. & vert. spacing) min. cover of 1 inch.
2. Welded wire fabric 6"x6"x6 gage.

Six inch lap required at construction joints for reinforcing steel.

EMBANKMENT PREPARATION: The embankment slope shall be cleared of all brush, debris, and rubble. A cushion is required for dirt embankment slopes. A cushion is not required for gravelly embankment slopes. All slopes shall be finished to a reasonably uniform surface or to the slope indicated in the bridge plans. All loose material shall be compacted to the satisfaction of the engineer. Adjacent slope area shall be left in a smooth, uniform condition.

State Highway Commission

Helena, Montana

METAL BIN-TYPE RETAINING WALL

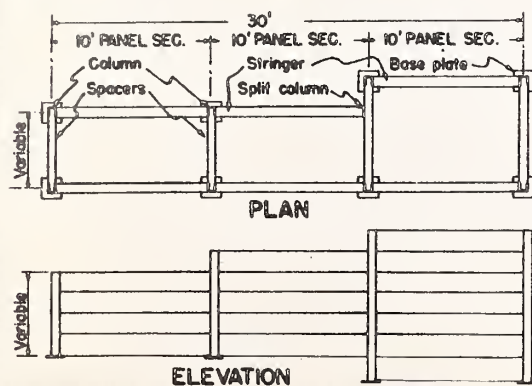
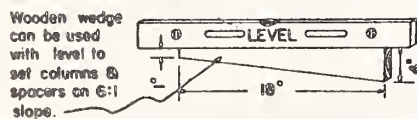
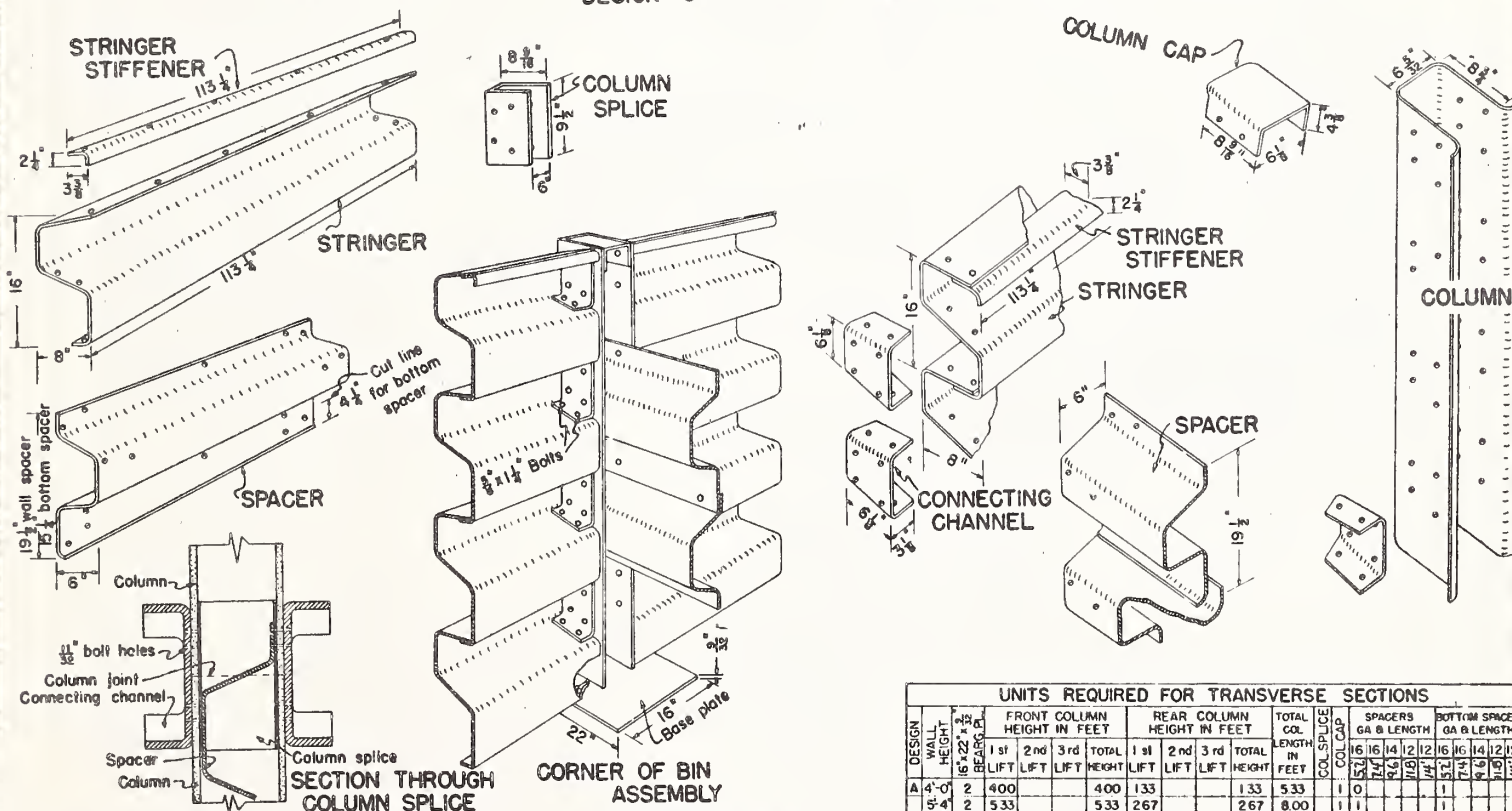
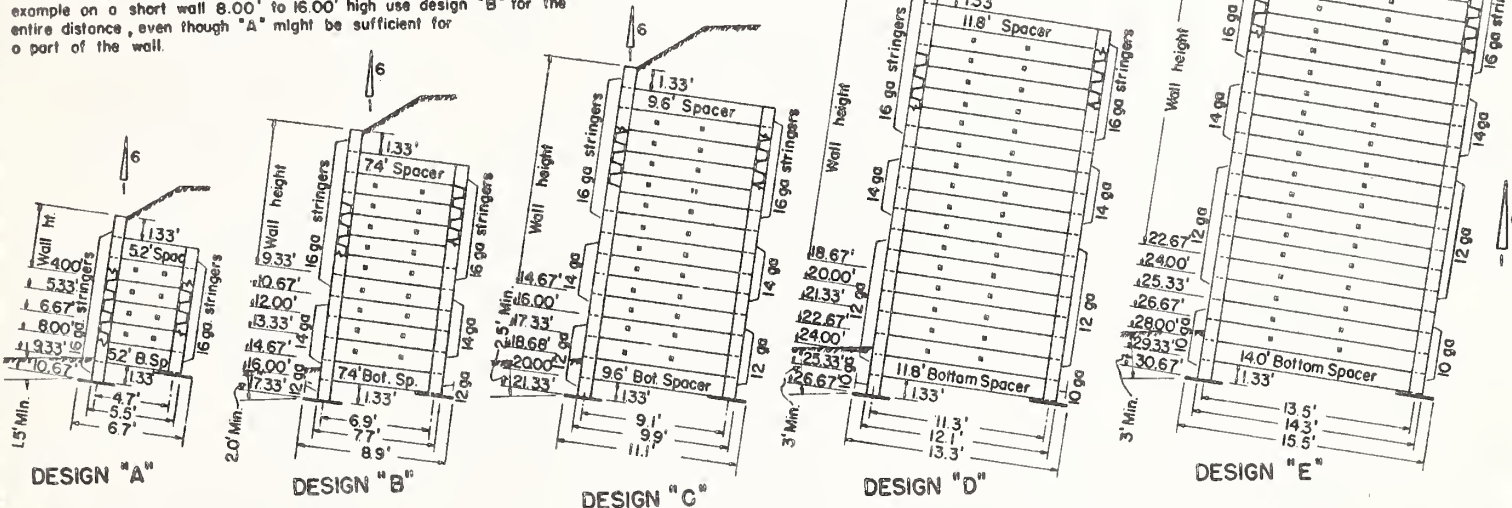
Approved

State Highway Engineer

SELECTION OF DESIGN

Walls with LEVEL SURCHARGE shall have a base width equal to approximately 45 % of the height. Walls with a SLIGHT SURCHARGE but with superimposed traffic loads near the wall shall have a base width equal 50 % of the height. Walls with INFINITE SURCHARGE shall have a base width equal to 55 % of the height.

At sites where "WALL HEIGHT" varies rapidly, use the same base width throughout. For example on a short wall 8.00' to 16.00' high use design "B" for the entire distance, even though "A" might be sufficient for a part of the wall.



UNITS REQ'D FOR PANEL SECS						
WALL HEIGHT	STRINGERS					STRNG STIFF. 9.5'
	16 Ga	14 Ga	12 Ga	10 Ga		
	9.5'	9.5'	9.5'	9.5'		
4'-0"	4					1
5'-4"	6					1
6'-8"	8					1
8'-0"	10					1
9'-4"	12					1
10'-8"	14					1
12'-0"	14	2				1
13'-4"	14	4				1
14'-8"	14	6				1
16'-0"	14	8				1
17'-4"	14	8	2			1
18'-8"	14	8	4			1
20'-0"	14	8	6			1
21'-4"	14	8	8			1
22'-8"	14	8	10			1
24'-0"	14	8	12			1
25'-4"	14	8	14			1
26'-8"	14	8	14	2		1
28'-0"	14	8	14	4		1
29'-4"	14	8	14	6		1
30'-8"	14	8	14	8		1

UNITS REQUIRED FOR TRANSVERSE SECTIONS																				
DESIGN	WALL HEIGHT	REAR COLUMN HEIGHT	FRONT COLUMN HEIGHT IN FEET				REAR COLUMN HEIGHT IN FEET				TOTAL COL LENGTH IN FEET	TOTAL COL	SPACERS GA B LENGTH				BOTTOM SPACER GA B LENGTH			
			1st LIFT	2nd LIFT	3rd LIFT	TOTAL HEIGHT	1st LIFT	2nd LIFT	3rd LIFT	TOTAL HEIGHT			16	14	12	10	16	14	12	10
A	4'-0"	2	400			400	133			133	533		1	0						
	5'-4"	2	533			533	267			267	800		1	1						
	6'-8"	2	667			667	400			400	1067		1	2						
	8'-0"	2	800			800	533			533	1333		1	3						
	9'-4"	2	933			933	667			667	1600		1	4						
B	10'-8"	2	1067			1067	300			800	1867		1	5						
	9'-4"	2	933			933	667			667	1600		1	4						
	10'-8"	2	1067			1067	800			800	1867		1	5						
	12'-0"	2	1200			1200	933			933	2133		1	6						
	13'-4"	2	800	533		1333	1067			1067	2400		1	7						
C	14'-8"	2	800	667		1467	1200			1200	2667		1	8						
	16'-0"	2	800	600		1600	800	533		1333	2933		2	9						
	17'-4"	2	1200	533		1733	800	667		1467	3200		2	10						
	14'-8"	2	800	667		1467	1200			1200	2667		1	8						
	16'-0"	2	800	800		1600	800	533		1333	2933		2	9						
D	17'-4"	2	1200	533		1733	800	667		1467	3200		2	10						
	18'-8"	2	1200	667		1867	800	600		1600	3467		2	11						
	20'-0"	2	1200	800		2000	1200	533		1733	3733		2	12						
	21'-4"	2	1200	933		2133	1200	667		1667	4067		2	13						
	22'-8"	2	1200	667		1867	800	800		1600	3467		2	11						
E	20'-0"	2	1200	800		2000	1200	533		1733	3733		2	12						
	21'-4"	2	1200	933		2133	1200	667		1867	4000		2	13						
	22'-8"	2	1200	1067		2267	1200	800		2000	4267		2	14						
	24'-0"	2	1200	1200		2400	1200	933		2133	4533		2	15						
	25'-4"	2	1200	800	533	2533	1200	1067		2267	4800		3	16						
	26'-8"	2	1200	800	667	2667	1200	1200		2400	5067		3	17						
	28'-0"	2	1200	1067		2267	1200	800		2000	4267		2	14						
	24'-0"	2	1200	1200		2400	1200	933		2133	4533		2	15						
	25'-4"	2	1200	800	533	2533	1200	1067		2267	4800		3	16						
	26'-8"	2	1200	800	667	2667	1200	1200		2400	5067		3	17						
	28'-0"	2	1200	800	800	2800	1200	800	533	2533	5333		4	1						
	29'-4"	2	2004	1200	533	2933	1200	800	667	2667	5600		4	1						
	30'-8"	2	1200	1200	667	3067	1200	800	800	2800	5867		4	1						

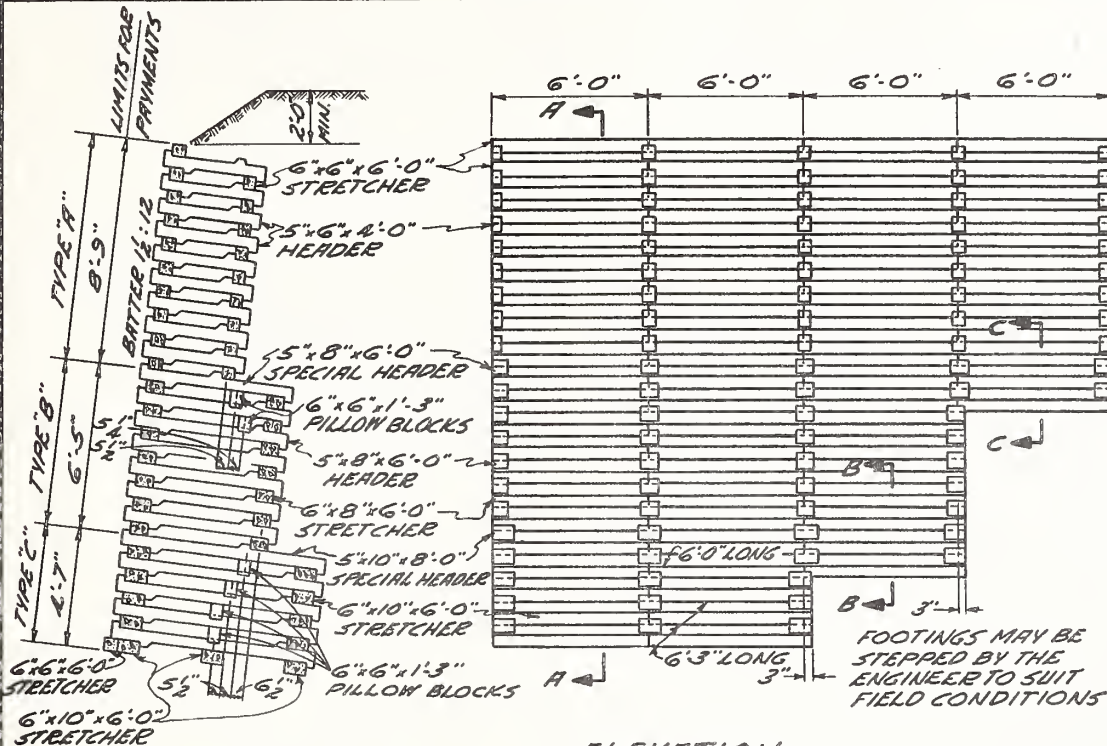
REVISED 8-1-63 11-20-68
EFFECTIVE 8-1-63 1-1-69

STANDARD DRAWING NO. 51-02

State Highway Commission
Helena, Montana

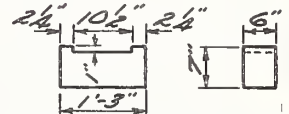
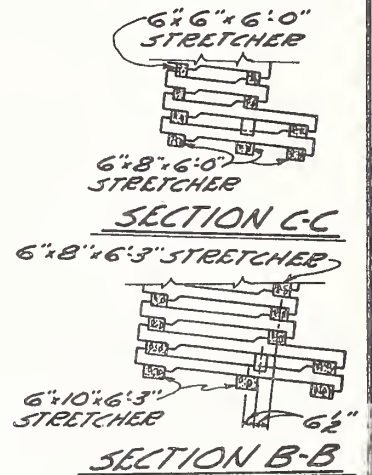
CONCRETE CRIB RETAINING WALL

Approved
State Highway Engineer

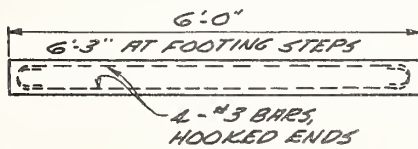


SECTION A-A

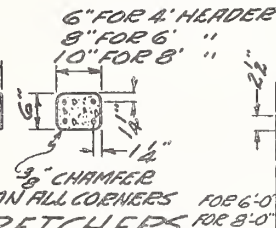
ELEVATION



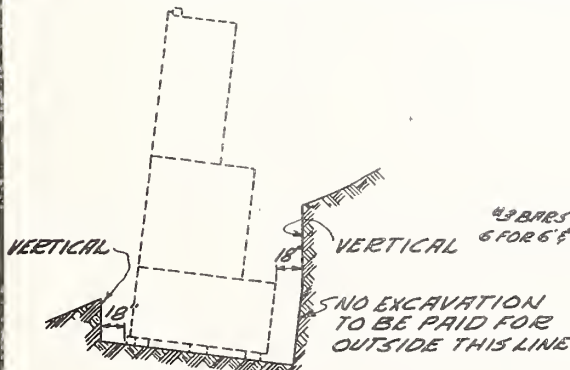
DETAIL OF PILLOW BLOCK



DETAIL OF STRETCHERS

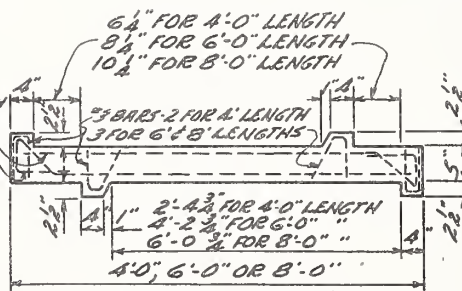


DETAIL OF SPECIAL HEADERS

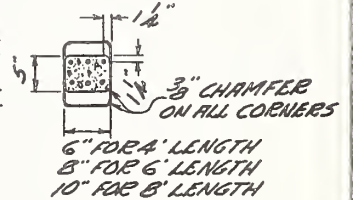


SECTION

SHOWING LIMITS FOR COMPUTING
STRUCTURE EXCAVATION



DETAIL OF HEADER



NOTES:

DESIGN: ANY OTHER DESIGN THAT WILL SERVE THE PURPOSE AS EFFECTIVELY AS THE DESIGN SHOWN HEREON, WILL BE PERMITTED UPON APPROVAL BY THE ENGINEER. SUCH APPROVAL WILL BE BASED ON CURRENT DRAWINGS AND SUPPORTING DATA SUBMITTED TO THE HELENA OFFICE.

THE DRAWING IS TO BE READ FROM TOP DOWN TO OBTAIN THE DESIGN FOR INTERMEDIATE HEIGHTS.

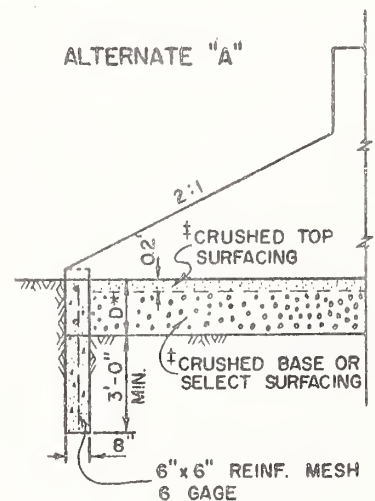
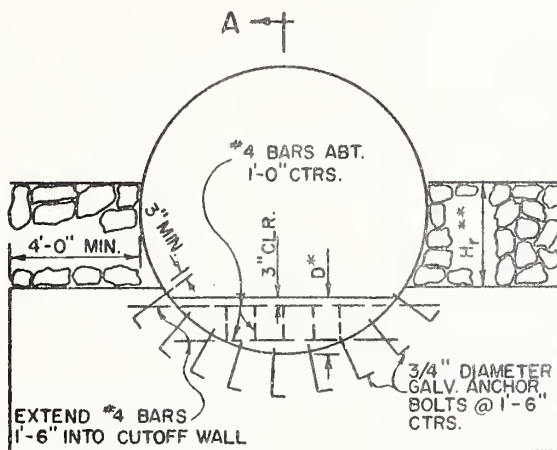
WALLS SHOULD BE DESIGNED AND ASSEMBLED IN SECTIONS \pm 96 FEET LONG WITH DOUBLE ROWS OF HEADERS AT ADJOINING ENDS.

DESIGN SHALL SHOW HEIGHT, LENGTH AND STEPS IN WALL. PROVIDE DRAINS WHERE NECESSARY.

CONCRETE: THE CONCRETE IN ALL UNITS SHALL BE DENSE, SOUND, VIBRATED AND CURED AND SHALL DEVELOP A COMPRESSIVE STRENGTH NOT LESS THAN 4000 LBS. PER SQ. INCH IN 28 DAYS. MAXIMUM SIZE AGGREGATE: $\frac{3}{4}$ ". CHAMFER ALL CORNERS.

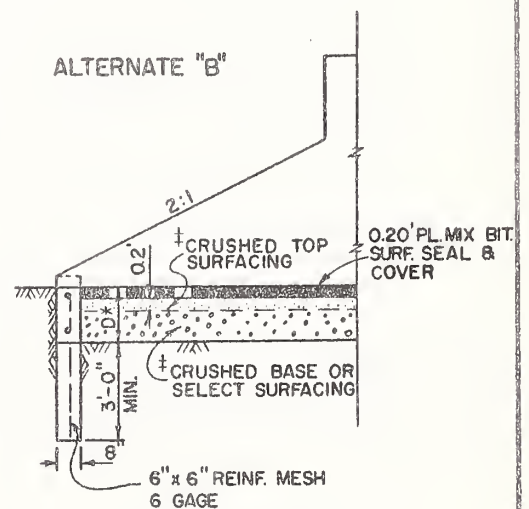
REINFORCING: REINFORCING SHALL BE MADE OF DEFORMED BARS AT LEAST $\frac{3}{8}$ " IN DIAMETER. BARS SHALL CONFORM TO AASHTO M 137. THE AREA OF REINFORCEMENT FOR EACH UNIT SHALL NOT BE LESS THAN 0.9% OF ITS GROSS CROSS-SECTIONAL AREA.

CONSTRUCTION: CONSTRUCTION AND PLACEMENT SHALL CONFORM TO SPECIFICATIONS AND SPECIAL PROVISIONS.



- * SEE STD. DWG. NO. 59-06
- * H_r = HEIGHT OF RIPRAP (SEE ROAD PLAN)
- ‡ ON THE DESIGN 102, THE BACKFILL MATERIAL SHALL BE CRUSHED TOP SURFACING ONLY.

DIAMETER (Inches)	CONCRETE QUANTITIES (CU. YDS.)		
	BACKFILL RETAINER	CUTOFF WALL	TOTAL CONCRETE
102	0.1	1.7	1.8
126	0.2	2.0	2.2
162	0.4	2.8	3.2
180	0.4	3.1	3.5
198	0.6	3.5	4.1
210	0.3	3.3	3.6



SECTION A-A

NOTE: CONCRETE SHALL BE CLASS "DD" OR EQUAL.

CONCRETE QUANTITIES ARE FOR ONE END ONLY.

REINFORCING MATERIAL TO BE INCLUDED IN UNIT PRICE BID PER CU. YD. CONC.

ANCHOR BOLTS TO BE INCLUDED IN THE UNIT PRICE BID PER LIN. FT. PIPE.

SURFACING QUANTITIES PER LINEAL FOOT									
DIAMETER (Inches)	ALTERNATE "A"		ALTERNATE "B"						
	CUBIC YARDS		TON		CUBIC YARD		TONS BITUM. MAT'L.		
	TOP SURF.	CR. BASE OR SEL. SURF.	COVER MAT'L.	PLANT MIX	TOP SURF.	CR. BASE OR SEL. SURF.	PRIME	PLANT MIX	SEAL
102	0.100	—	—	—	—	—	—	—	—
126	0.047	0.156	0.0093	0.096	0.045	0.111	0.0009	0.0062	0.0009
162	0.073	0.489	0.0139	0.146	0.069	0.408	0.0014	0.0095	0.0014
180	0.073	0.446	0.0142	0.148	0.071	0.375	0.0014	0.0096	0.0014
198	0.088	0.712	0.0167	0.176	0.084	0.627	0.0017	0.0114	0.0017
210	0.074	0.333	0.0140	0.141	0.067	0.267	0.0014	0.0092	0.0014

REVISED	7-9-68	10-25-68	11-16-70
EFFECTIVE	11-1-68	1-1-69	1-1-71

STANDARD DRAWING NO. 54-01

State Highway Commission
Helena, Montana

R.C.P. CULVERT BEDDING

Approved
Samuel B. Bristow 9-22-68
State Highway Engineer

DESCRIPTION OF BEDDING CLASSES

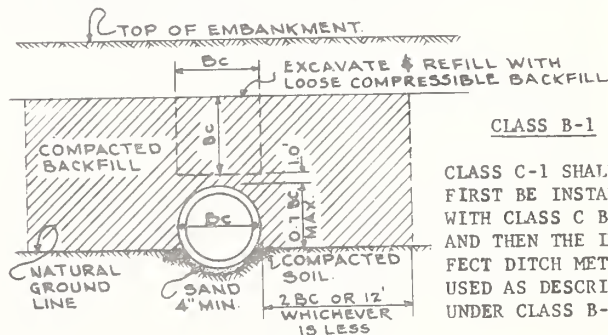
CLASS A CONCRETE CRADLE BEDDING. THE LOWER PART OF THE PIPE EXTERIOR SHALL BE BEDDED IN A CONTINUOUS CRADLE CONSTRUCTED OF 2000 POUND CONCRETE OR BETTER, HAVING A MINIMUM THICKNESS UNDER THE PIPE OF ONE-FOURTH THE NOMINAL INSIDE DIAMETER AND EXTENDING UP THE SIDES OF THE PIPE FOR A HEIGHT EQUAL TO ONE-FOURTH OF THE OUTSIDE DIAMETER. THE CRADLE SHALL HAVE A WIDTH AT LEAST EQUAL TO THE OUTSIDE DIAMETER OF THE PIPE PLUS 8" AND IT SHALL BE CONSTRUCTED MONOLITHICALLY WITHOUT HORIZONTAL CONSTRUCTION JOINTS.

CLASS B BEDDING. (1) THIS CLASS OF BEDDING FOR EMBANKMENT CONDITION IS APPLICABLE ONLY WHEN THE PROJECTION RATIO IS NOT GREATER THAN 0.7. THE PIPE SHALL BE CAREFULLY BEDDED ON FINE GRANULAR MATERIALS OVER AN EARTH FOUNDATION, ACCURATELY SHAPED BY MEANS OF A TEMPLATE TO FIT THE LOWER PART OF THE PIPE EXTERIOR FOR AT LEAST 10% OF THE CULVERT OVERALL HEIGHT. COMPACTABLE SOIL MATERIAL SHALL THEN BE RAMMED AND TAMPED IN LAYERS NOT MORE THAN 6" THICK, AROUND THE PIPE FOR THE REMAINDER OF THE LOWER 20% OF ITS HEIGHT. BACKFILLING TO THE TOP OF THE PIPE SHALL CONFORM WITH THE APPLICABLE PROVISIONS OF THE STANDARD SPECIFICATIONS.

(2) FOR TRENCH CONDITIONS, THE CULVERT IS PLACED AS DESCRIBED IN B(1) EXCEPT THAT THE EARTH FOUNDATION NEEDS TO BE SHAPED TO FIT THE LOWER PART OF THE CULVERT EXTERIOR FOR A WIDTH OF AT LEAST 60% OF THE CULVERT BREADTH. THEN THE REMAINDER OF THE CULVERT IS ENTIRELY SURROUNDED TO A HEIGHT OF AT LEAST 12" ABOVE ITS TOP BY GRANULAR MATERIAL PLACED BY HAND TO FILL ALL SPACES UNDER AND ADJACENT TO THE CULVERT. THE FILL IS TAMPED THOROUGHLY ON EACH SIDE AND UNDER THE CULVERT AS FAR AS PRACTICABLE IN LAYERS NOT TO EXCEED 6" IN THICKNESS.

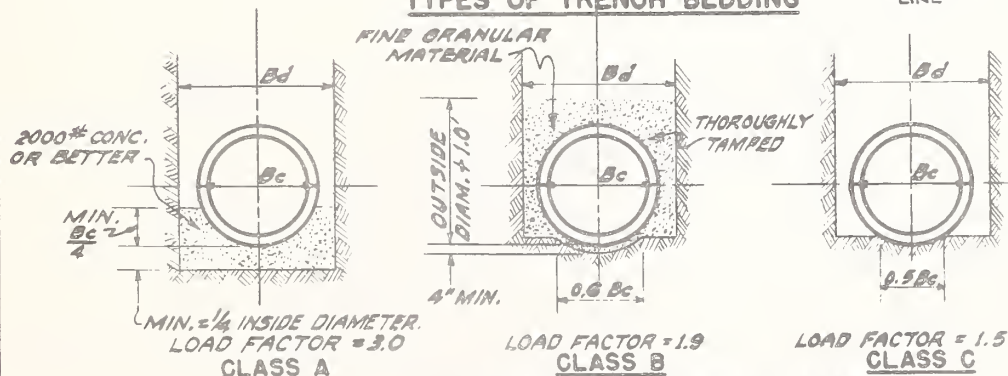
CLASS B-1 BEDDING. IN THIS TYPE OF INSTALLATION, SOMETIMES CALLED THE IMPERFECT TRENCH METHOD, THE PIPE CULVERT SHALL BE FIRST INSTALLED IN ACCORDANCE WITH THE REQUIREMENTS OF B(2). THEN THE FILL SHALL BE COMPACTED AT EACH SIDE OF THE PIPE FOR A LATERAL DISTANCE EQUAL TO TWICE THE OUTSIDE DIAMETER OR 12", WHICHEVER IS LESS, AND CARRIED UP TO AN ELEVATION EQUAL TO THE OUTSIDE DIAMETER OF THE PIPE PLUS 12", ABOVE THE TOP OF THE PIPE. NEXT A TRENCH EQUAL IN WIDTH TO THE OUTSIDE DIAMETER OF THE PIPE SHALL BE DUG IN THE FILL DIRECTLY OVER THE CULVERT, DOWN TO AN ELEVATION 12" ABOVE THE TOP OF THE PIPE. CARE SHALL BE EXERCISED TO KEEP THE SIDES AS VERTICAL AS POSSIBLE. AFTER THE TRENCH IS EXCAVATED, IT SHALL BE REFILLED WITH LOOSE, HIGHLY COMPRESSIBLE SOIL MATERIAL. STRAW, HAY, LEAVES, BRUSH OR SAWDUST MAY BE USED TO FILL THE LOWER ONE-FOURTH TO ONE-THIRD OF THE TRENCH IN ORDER TO INSURE HIGH COMPRESSIBILITY OF THIS BACKFILL. THE BACKFILL OF STRAW, HAY, ETC. SHALL NOT BE CARRIED CLOSER THAN 10' TO THE OUTSIDE SLOPE OF THE FILL; THE OUTSIDE 10' SHALL BE COMPOSED OF IMPERVIOUS MATERIAL, THOROUGHLY COMPACTED. AFTER THE BACKFILL IS COMPLETED, THE BALANCE OF THE FILL SHALL BE CONSTRUCTED BY NORMAL METHODS UP TO THE FINISHED GRADE OF EMBANKMENT.

CLASS C-1 BEDDING. THE PIPE SHALL BE INSTALLED IN ACCORDANCE WITH CLASS C BEDDING. THE IMPERFECT TRENCH METHOD SHALL THEN BE USED AS DESCRIBED UNDER CLASS B-1 BEDDING.

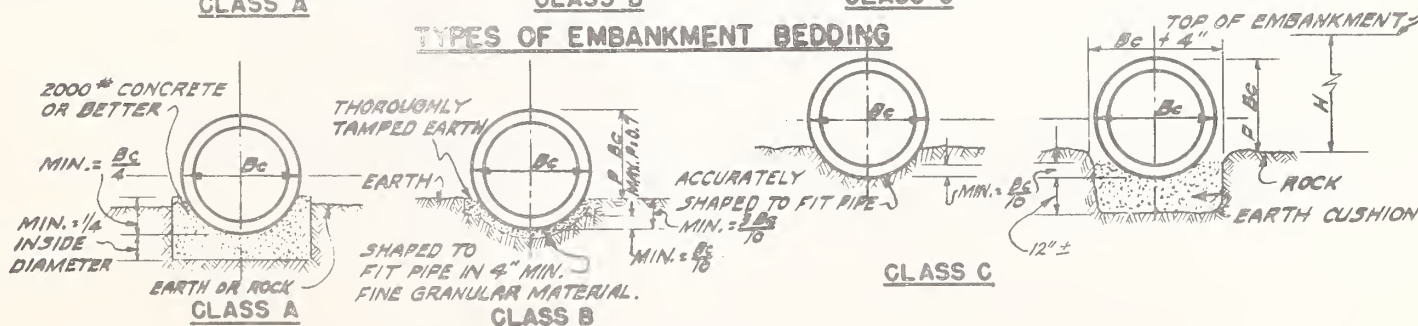


CLASS C-1 SHALL FIRST BE INSTALLED WITH CLASS C BEDDING, AND THEN THE IMPERFECT DITCH METHOD USED AS DESCRIBED UNDER CLASS B-1.

TYPES OF TRENCH BEDDING



TYPES OF EMBANKMENT BEDDING



WHEN NATURAL GROUND MATERIAL SIMULATES BEDDING MATERIAL, NO SPECIAL BEDDING MATERIAL NEED BE USED. USE CLASS "C" UNLESS OTHERWISE NOTED ON PLANS.

[illegible]

Approved
Emory C. Patton 12-9-68
State Highway Engineer

TYPICAL FIELD CAST CONCRETE BEND
R.C.P. TO C.M.P. CONNECTION DETAIL



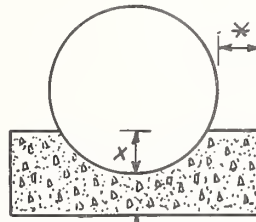
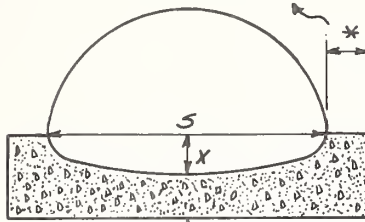
State Highway Commission
Helena, Montana

BEDDING MATERIAL

Approved

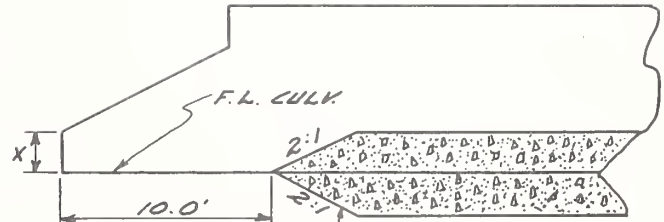
James M. Sullivan
State Highway Engineer

*AS DIRECTED WITHIN 2.0' TO 6.0' FOR PIPES
GREATER THAN 60" DIAMETER OR SPAN.
2.0' FOR SMALLER PIPES.



2.0' FOR ALL PIPE SIZES
UNLESS OTHERWISE DIRECTED

FOR X DIST. SEE STD. DRAWINGS
NO'S. 59-01 59-03 59-04 & 59-05



IF SUITABLE FOR
FOUNDATION, THIS
MATERIAL SHOULD
BE UNDISTURBED
AND BEDDING
AROUND PIPE
COMPOSED OF
EARTH TO PROVIDE
SEAL

SEE STD. SPECIFICATIONS
FOR GRADATION OF
BEDDING MATERIAL

CIRCULAR C.S.P. & S.S.P.P.C.

DIAMETER OF PIPE (IN.)	CU. YDS. BEDDING MAT'L. REQ'D. PER LIN. FT. FOR 2.0' THICKNESS	DIAMETER OF PIPE (IN.)	CU. YDS. BEDDING MAT'L. REQ'D. PER LIN. FT. FOR 2.0' THICKNESS
60	0.94	162	2.45
66	1.02	168	2.55
72	1.09	174	2.66
78	1.16	180	2.77
84	1.23	192	2.99
90	1.33	198	3.10
96	1.41	204	3.22
102	1.50	210	3.34
108	1.58	216	3.45
114	1.67	228	3.69
120	1.76	240	3.94
126	1.85	252	4.20
132	1.95		
133	2.04		
144	2.14		
150	2.24		
156	2.34		

STRUCTURAL PLATE PIPE ARCH

SPAN	RISE	CU. YDS. BEDDING MAT'L. REQ'D. PER LIN. FT. FOR 2.0' THICKNESS		
		1 1/2:1 BEV.	2:1 BEV.	2 1/2:1 BEV.
18" CORNER PLATES				
6'1"	4'7"	1.16	1.16	1.16
6'9"	4'11"	1.23	1.23	1.23
7'3"	5'3"	1.19	1.19	1.19
7'11"	5'7"	1.30	1.30	1.30
8'7"	5'11"	1.37	1.37	1.37
9'4"	6'3"	1.47	1.47	1.47
9'9"	6'7"	1.44	1.44	1.44
10'8"	6'11"	1.68	1.68	1.68
11'5"	7'3"	1.74	1.74	1.74
11'10"	7'7"	1.68	1.68	1.68
12'6"	7'11"	1.80	1.80	1.80
12'10"	8'4"	1.75	1.75	1.75
31" CORNER PLATES				
14'0"	9'8"	2.13	2.13	2.13
15'4"	10'8"	2.31	2.31	2.31
16'6"	11'0"	2.36	2.36	2.36
17'11"	11'8"	2.58	2.58	2.58
18'3"	12'4"	2.77	2.77	2.77
20'5"	13'0"	2.91	2.91	2.91

STRUCT. PLATE PIPE ARCH STOCK & VEHICULAR UNDERPASS

SPAN	RISE	CU. YDS. BEDDING MAT'L. REQ'D. PER L.F. (2" THICK)
12-2	11-0	2.03
13-10	12-2	2.25
14-10	14-0	2.37
15-8	15-0	2.40
16-5	16-0	2.49
17-3	17-0	2.76
19-1	17-2	3.09
20-4	17-9	3.21

STRUCT. PLATE PIPE STOCKPASS

DESIGN	SPAN	RISE	CU. YDS. BEDDING MAT'L. REQ'D. PER L.F. (2" THICK)
A	5'10"	6'6"	0.99
B	5'10"	7'7"	0.99

REVISED	7-1-63	11-20-68
EFFECTIVE	7-1-63	1-1-69

STANDARD DRAWING NO. 54-04

State Highway Commission
Helena, Montana

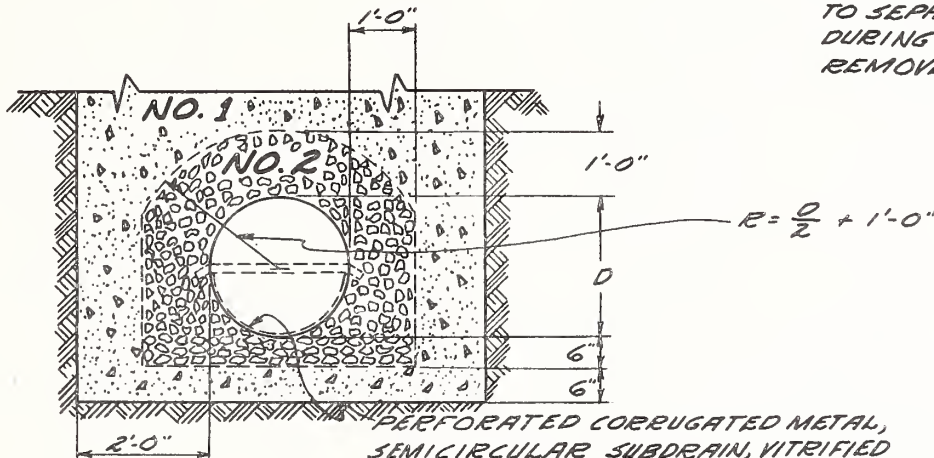
FILTER MATERIAL FOR UNDERDRAINS

Approved
James G. Chittum 12-9-68
State Highway Engineer

FOR PERFORATED CORRUGATED METAL PIPE, SEMICIRCULAR SUBDRAIN
OR *OPEN JOINT CONCRETE PIPE

NOTE:

USE PULLBOARDS OF D+6" HEIGHT
TO SEPARATE NO. 1 & NO. 2 MATERIAL
DURING PLACEMENT AND THEN
REMOVE.



PERFORATED CORRUGATED METAL,
SEMICIRCULAR SUBDRAIN, VITRIFIED
TILE, CONCRETE OR ANY OTHER PIPE
AS SPECIFIED ON PLANS.

FILTER GRADATION	PERCENT PASSING STD. A.S.T.M. SIEVE											
	2	1 1/2	1 1/4	1	3/4	1/2	3/8	NO. 4	8	16	50	100
NO. 1							100	95-100	65-95	35-80	5-30	0-10
NO. 2	100	95-100	70-95		35-70		10-30	0-5				

*NOTE:

WHEN OPEN JOINT PIPE IS USED JOINT SHOULD BE
WRAPPED WITH BRASS, BRONZE OR COPPER NO. 4
MESH HARDWARE CLOTH BEFORE FILTER MATERIAL
IS PLACED.

BOTH GRADATIONS SHALL BE COMBINED AND BID
AS "FILTER MATERIAL."

SYPHON PIPE

APPROVED

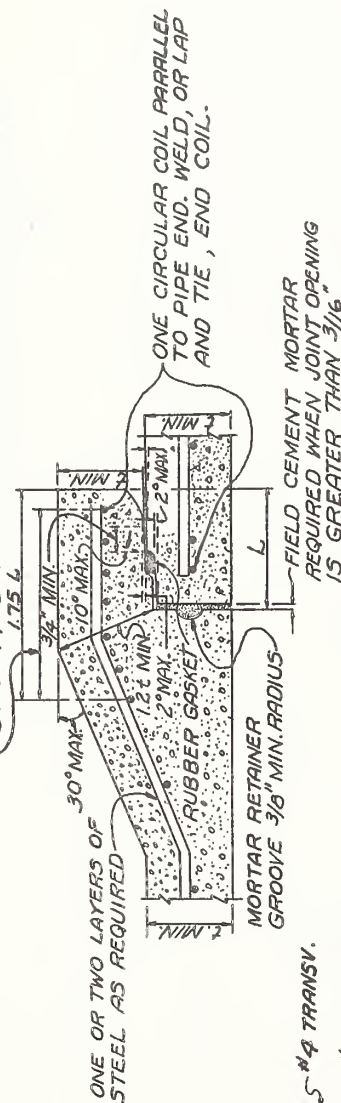
Sam H. Chatter 12-9-68
STATE HIGHWAY ENGINEER



NOTES:

5 OR 3, SHALL NOT EXCEED 15' FOR C.M.P. OR E.C.P. WITH RUBBER GASKETED JOINTS CONFORMING TO STANDARD SPECIFICATIONS WITH 5 OR 3, FROM 15' TO 35' USE E.C.P. WITH TYPE 23 JOINTS OR WELDED STEEL PIPE. FOR 5 OR 3, OVER 35', USE WELDED STEEL PIPE.

THE AREA OF CIRCUMFERENTIAL STEEL IN THE BELL SHALL NOT BE LESS THAN THAT PROVIDED FOR AN EQUIVALENT LENG. OF THE PIPE BARREL PLUS AN AREA EQUAL TO .005(D+2t) WHERE D IS THE INTERNAL DIAMETER. OF THE PIPE AND t IS THE MINIMUM SHELL THICKNESS SPECIFIED FOR THE CLASS AND SIZE OF PIPE

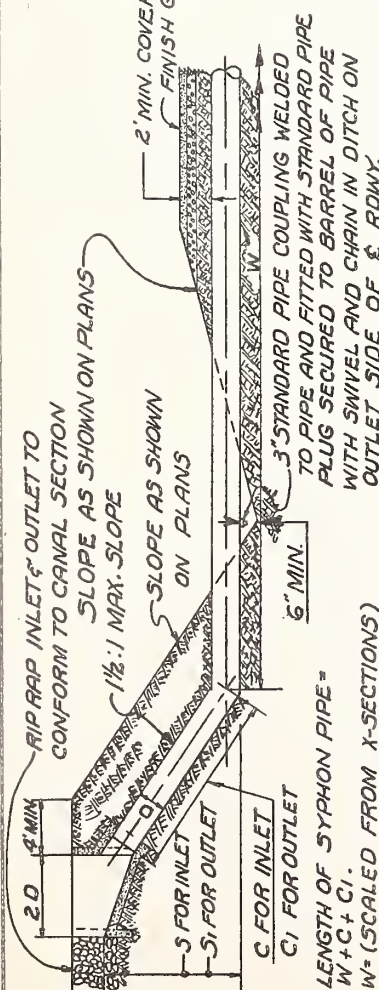


TYPE R-3 JOINT

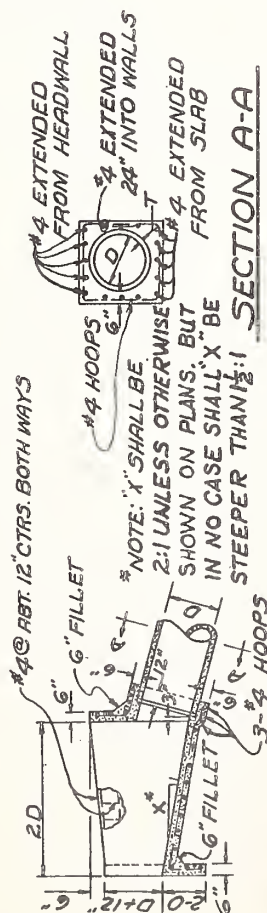
Notes:

ALL CONCRETE SHALL BE CLASS "DD".
CHAMFER ALL EXPOSED EDGES $\frac{3}{4}$ "
AND FILLET ENTRANT ANGLES $\frac{3}{4}$ " UNLESS
OTHERWISE NOTED. REINF. STEEL SHALL BE
INCLUDED IN UNIT PRICE BID FOR CONC.

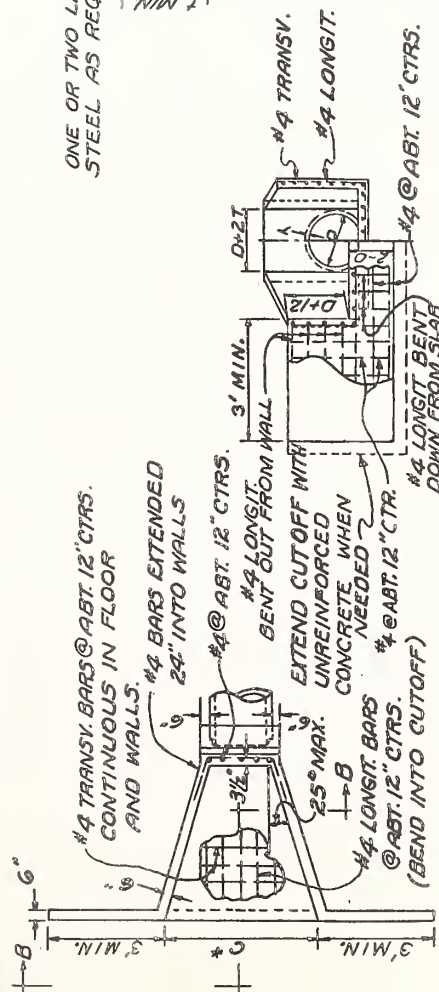
HEAD WALL QUANTITY	CLASS "DD" OR EQUAL		1.6 cords.
	"D" SIZE	"C" FT.	
	18"	2.5	2.2 "
	24"	3.5	3.1 "
	30"	4.0	3.9 "
	36"	4.5	4.9 "
	42"	5.0	6.2 "
	48"	5.5	



INSTALLATION NO. 1 C.M.P. ONLY
INSTALLATION SYMMETRICAL ABOUT & ROADWAY



LONGITUDINAL SECTION

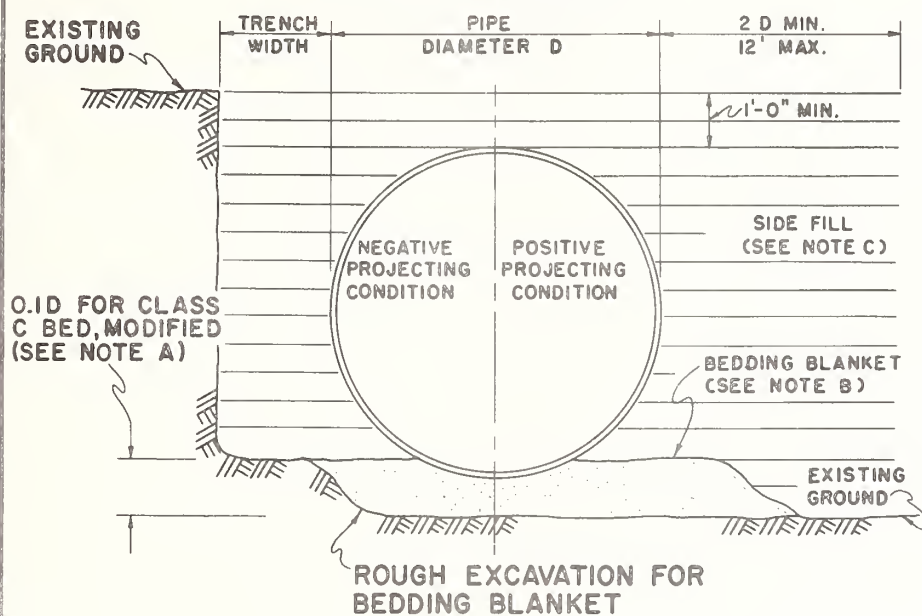


PLAY

SECTION B-B

*NOTE: "C" SHALL BE AS SHOWN IN SECTION 01050. QUANTITY BOX UNLESS OTHERWISE SHOWN ON PLANS. BUT IN NO CASE SHALL "C" BE LESS THAN "D".

I-PIPE INSTALLATION AND BEDDING
(CLASS C, MODIFIED)



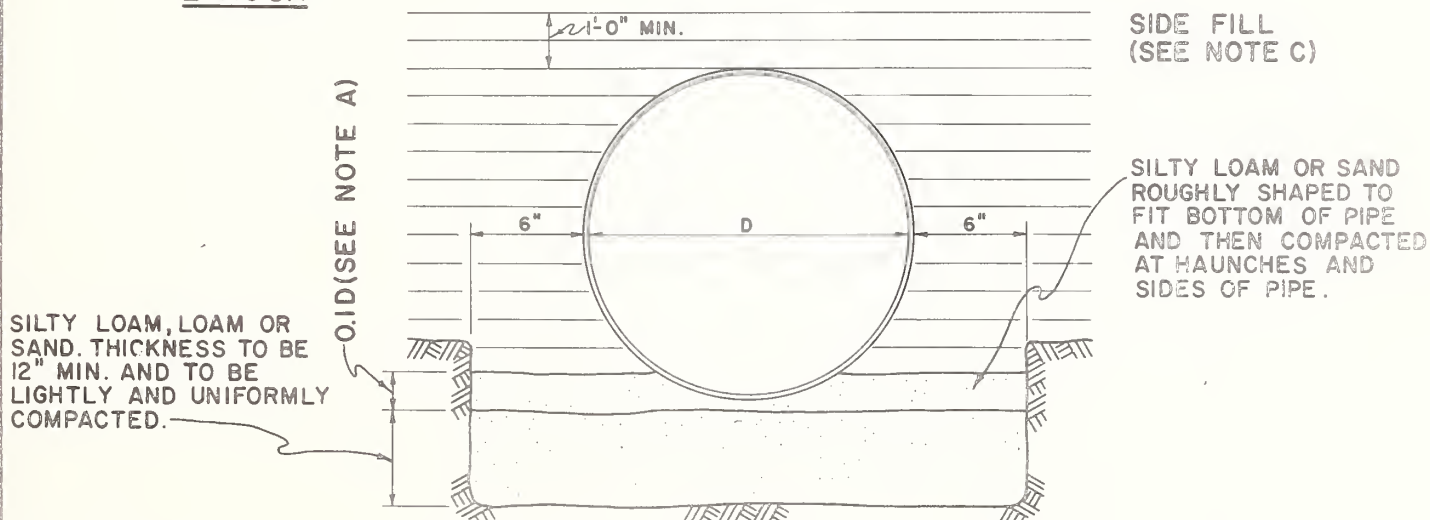
NOTES

(A) FOR STRUCTURAL PLATE PIPE, THE LENGTH OF BEDDING ARC NEED NOT EXCEED WIDTH OF BOTTOM PLATE.

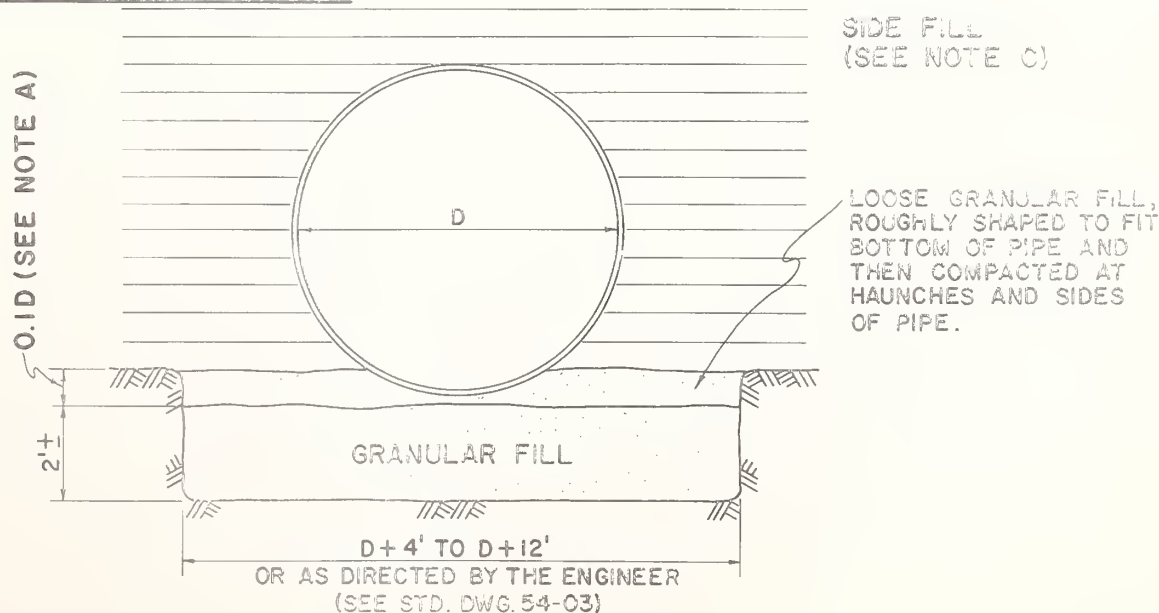
(B) BEDDING BLANKET OF SILTY LOAM OR SAND ROUGHLY SHAPED TO FIT BOTTOM OF PIPE. MINIMUM THICKNESS BEFORE PLACING PIPE IS 3".

(C) SIDE FILL TO BE COMPACTED IN 6" LAYERS TO DENSITY SPECIFIED FOR ADJACENT EMBANKMENT. SEE ARTICLE 11.05 OF STANDARD SPECS. FOR THE DENSITY REQUIREMENTS.

2-ROCK



3-FOUNDATION STABILIZATION



REVISED			STANDARD DRAWING NO. 56-01
EFFECTIVE	1-1-71		
STATE HIGHWAY COMMISSION HELENA, MONTANA		FILL HEIGHT FOR C.S.P., H-20 LOADING 2 ² / ₃ " X 1/2" CORRUGATIONS	APPROVED <i>[Signature]</i> STATE HIGHWAY ENGINEER

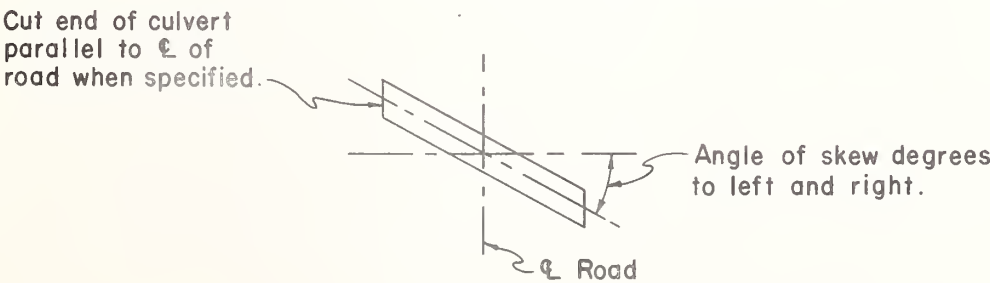
FOR CORRUGATED STEEL PIPE, 2²/₃-INCH BY 1/2-INCH CORRUGATIONS, RIVETED WELDED, OR HELICAL FABRICATION, H-20 LOADING.

PIPE DIAMETER IN INCHES	MINIMUM COVER, TOP OF PIPE TO TOP OF SUBGRADE (INCHES)	AREA IN SQUARE FEET	MAXIMUM FILL HEIGHTS ABOVE TOP OF PIPE IN FEET				
			METAL THICKNESS IN INCHES				
			0.064	0.079	0.109	0.138	0.168
12	12	0.8	84	91			
15	12	1.2	67	73			
18	12	1.8	56	61			
24	12	3.1	42	46	59		
30	12	4.9	34	36	47		
36	12	7.1	28	30	39	41	
42	12	9.6	31	43	46(67)	48(70)	50(73)
48	12	12.6	27	37	45(58)	46(61)	47(64)
54	12	15.9		33	43(52)	44(54)	45(57)
60	12	19.6			43(47)	43(49)	44(51)
66	12	23.8			42	43	43(47)
72	12	28.3				41	43
78	12	33.2					39
84	12	38.5					35

NOTES: VALUES FOR ELONGATED PIPE ARE SHOWN IN PARENTHESIS. USE SPECIAL DESIGN FOR STRUCTURES WITH HEIGHTS OF COVER EXCEEDING THESE TABLES.

SEE STD. DWG. 56-02 FOR GALVANIZED STEEL THICKNESS AND GAGE TABLE.

IF SKEW IS REQUIRED SEE STD. DWG. NO. 56-01.



NOTE: When skew angle exceeds 20° and the pipe arch has the ends cut to fit a slope, ends shall be reinforced with masonry.

REVISED				STANDARD DRAWING NO. 56-02
EFFECTIVE	1-1-71			
STATE HIGHWAY COMMISSION		FILL HEIGHT FOR C.S.P., H-20		APPROVED
HELENA, MONTANA		LOADING, 3"X1" CORRUGATIONS		<i>James H. Phillips</i> STATE HIGHWAY ENGINEER

FOR CORRUGATED STEEL PIPE, 3-INCH BY 1-INCH CORRUGATIONS, RIVETED, WELDED, HELICAL, OR BOLTED FABRICATION, H-20 LOADING.

PIPE DIAMETER IN INCHES	MINIMUM COVER, TOP OF PIPE TO TOP OF SUBGRADE (INCHES)	AREA IN SQUARE FEET	MAXIMUM FILL HEIGHTS ABOVE TOP OF PIPE IN FEET				
			METAL THICKNESS IN INCHES				
			0.064	0.079	0.109	0.138	0.168
36	12	7	48	60	78(88)	89(106)	101(118)
42	12	10	41	51	64(76)	71(91)	79(101)
48	12	13	36	45	57(66)	61(80)	66(88)
54	12	16	32	40	52(59)	55(71)	59(79)
60	12	20	29	36	49(53)	51(64)	54(71)
66	12	24	26	33	47	49(58)	51(64)
72	12	28	24	30	44	47(53)	49(59)
78	12	33	22	28	41	46(49)	47(54)
84	12	38	21	26	38	45	46(51)
90	12	44	19	24	35	43	45
96	12	50	18	22	33	40	44
102	24	57	17	21	31	38	42
108	24	64		20	30	35	39
114	24	71		19	28	34	37
120	24	78			27	32	35

NOTES: VALUES FOR ELONGATED PIPE ARE SHOWN IN PARENTHESIS. USE SPECIAL DESIGN FOR STRUCTURES WITH HEIGHTS OF COVER EXCEEDING THESE TABLES.

IF SKEW IS REQUIRED SEE STD. DWG. NO. 56-01.

GALVANIZED STEEL THICKNESS AND GAGES

ZINC COATED STEEL THICKNESS IN INCHES	GAGE NO. FOR INFORMATIONAL PURPOSES ONLY
0.064	16
0.079	14
0.109	12
0.188	10
0.168	8
0.168	7
0.218	5
0.249	3
0.280	1

REVISED	8-1-67	11-20-68	12-5-69	STANDARD DRAWING NO. 56-03
EFFECTIVE	8-1-67	1-1-69	1-1-70	
State Highway Commission		THICKNESS FOR CORRUGATED STEEL PIPE		Approved
Helena, Montana		3x1 CORRUGATION H-20 LOADING		<i>James H. Chaffin</i> State Highway Engineer

FILL HEIGHT FOR CIRCULAR CORRUGATED STEEL PIPE						
SEAM FABRICATION		SPOT WELDED OR BOLTED ($\frac{1}{2}$ " A325 Bolts)				
		$\frac{7}{8}$ " Rivets		$\frac{7}{16}$ " Rivets		
		HEIGHT OF COVER (Feet)				
AREA Sq. Ft.	DIAMETER Inches	0.064"	0.079"	0.109"	0.138"	0.168"
13	48	24	27	30	34	38
16	54	22	24	26	29	32
20	60	21	22	24	26	28
24	66	20	20	22	23	25
28	72	19	20	21	22	23
33	78	18	19	20	21	22
38	84		19	19	20	21
44	90		18	19	19	20
50	96			18	19	20
57	102			18	19	19
64	108			18	19	19
71	114				18	19
78	120				18	19

FILL HEIGHT FOR ELONGATED CORRUGATED STEEL PIPE						
SEAM FABRICATION		SPOT WELDED OR BOLTED($\frac{1}{2}$ " A325 Bolts)				
		$\frac{3}{8}$ Rivets		$\frac{7}{16}$ Rivets		
		HEIGHT OF COVER (Feet)				
AREA Sq. Ft.	DIAMETER (In.)	0.064"	0.079"	0.109"	0.138"	0.168"
13	48	32	44	60	68	76
16	54	29	39	52	58	64
20	60	25	35	48	52	56
24	66	23	32	44	46	50
28	72	22	29	42	44	46
33	78	20	27	40	42	44
38	84		25	38	40	42
44	90		23	37	38	40
50	96			35	38	39
57	102			33	36	37
64	108			31	34	35
71	114				32	33
78	120				30	32

NOTES: Use special design for structures with
Heights of cover exceeding these tables.
If skew is required see Std. Dwg. No 56-01
Minimum cover 2 Ft.

REVISED	9-21-66	11-20-68	12-10-69
EFFECTIVE	2-1-67	1-1-69	1-1-70

STANDARD DRAWING NO. 56-04

State Highway Commission
Helend, Montana

THICKNESS FOR CORRUGATED & STRUCTURAL PLATE PIPES
FOR RAILROAD COOPER E 72 LIVE LOAD

Approved
James H. Patton 12-7-68
State Highway Engineer

THICKNESS OF CORRUGATED METAL PIPE
(ROUND OR VERTICALLY ELONGATED)

Diam. in Inches	Area in Sq. Ft.	Height of Cover Above Top of Culvert - in Feet									
		1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100
18	1.8	0.079	0.079	0.079	0.079	0.079	0.079	0.109	0.109	0.109	0.109
21	2.4	0.079	0.079	0.079	0.079	0.079	0.109	0.109	0.109	0.138	0.138
24	3.1	0.079	0.079	0.079	0.079	0.109	0.109	0.109	0.138	0.138	0.138
30	4.9	0.079	0.079	0.109	0.109	0.138	0.138	0.138	0.168*	0.168*	0.168*
36	7.1	0.109	0.109	0.109	0.138	0.168	0.168	0.168*	0.168*	0.168*	0.168*
42	9.6	0.109	0.109	0.138	0.168	0.168					
+ 42	9.6					0.168	0.168*	0.168*	0.168*	0.168*	0.168*
+ 48	12.6	0.138	0.138	0.168	0.168	0.168	0.168	0.168*	0.168*	0.168*	0.168*
+ 54	15.9	0.168	0.168	0.168	0.168	0.168*	0.168*	0.168*	0.168*		
+ 60	19.6	0.168	0.168	0.168	0.168	0.168*					
+ 66	23.8	0.168	0.168	0.168*							
+ 72	28.3	0.168	0.168*								

* Make a trench one diameter deep in original soil or in compacted fill.
The gages shown are the minimum structural requirements for use with
adequate backfill.

For recommended minimum height of cover, see below.

+ Values below line are based on vertical elongation of pipe.

THICKNESS OF CORRUGATED
METAL PIPE-ARCHES

Diam of Pipe of Equal Periph. in Inches	Span in Inches	Rise in Inches	Height of Cover – in Feet			
			2	3-4	5-7	8-15
			Recom. Minimum THKS.			
15	18	11	0.079	0.079	0.079	0.079
18	22	13	0.079	0.079	0.079	0.079
21	25	16	0.109	0.079	0.079	0.079
24	29	18	0.109	0.109	0.079	0.079
30	36	22	0.138	0.109	0.109	0.109
36	43	27	0.168	0.138	0.138	0.109
42	50	31		0.168	0.138	0.138
48	58	36			0.168	0.168
54	65	40				0.168
60	72	44				0.168

EQUIVALENT GAGE NUMBERS	
GAGE	THICKNESS
16	0.064
14	0.079
12	0.109
10	0.138
8	0.168

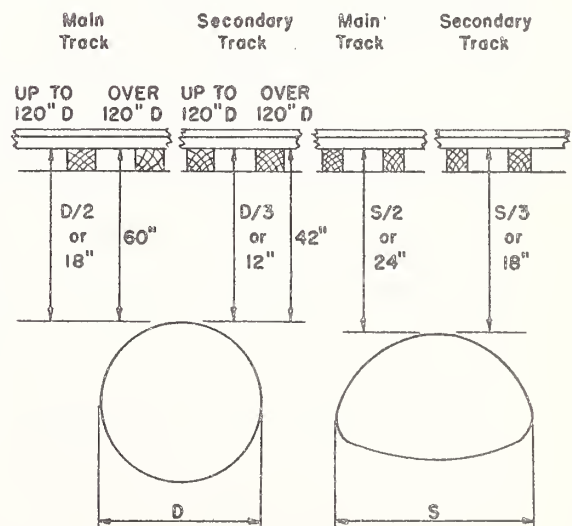
GAGES OF STRUCTURAL PLATE PIPE
(VERTICALLY ELONGATED)

Diam. in Inches	Height of Cover - in Feet																	
	1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45	46-50	51-55	56-60	61-70	71-80	81-90	91-100		
60	12	12	12	12	12	12	12	12	12	12	10	10	8	7	5	5		
66	12	12	12	12	12	12	12	12	12	10	10	8	8	7	5	3		
72	12	12	12	12	12	12	12	12	10	10	8	8	7	5	3	1		
78	10	12	12	12	12	12	12	10	10	8	8	8	5	3	1			
84	10	12	12	12	12	12	12	10	10	8	8	7	5	3	1			
90	10	12	12	12	12	12	10	10	8	8	7	5	3	1				
96	8	12	12	12	12	10	10	10	8	7	7	5	3	1				
108	8	10	10	10	10	10	8	7	5	5	3	1						
120	8	10	10	10	10	10	8	7	5	5	3	1						
132	8	10	10	10	10	8	8	7	5	3	1	1						
144	7	8	10	10	8	8	7	5	3	1	1							
156	7	8	8	8	8	8	5	3	1	1								
168	7	8	8	8	8	7	5	3	1									
180	7	8	8	8	8	5	3	1										

Use special design for
structures with height
of cover exceeding
this table.

PIPE

PIPE-ARCHES



Minimum height of cover for corrugated metal
structures under Cooper E 50 to E 72 railroad
loadings, for main and secondary tracks.

REVISED	1-1-64	11-20-68
EFFECTIVE	1-1-64	1-1-69

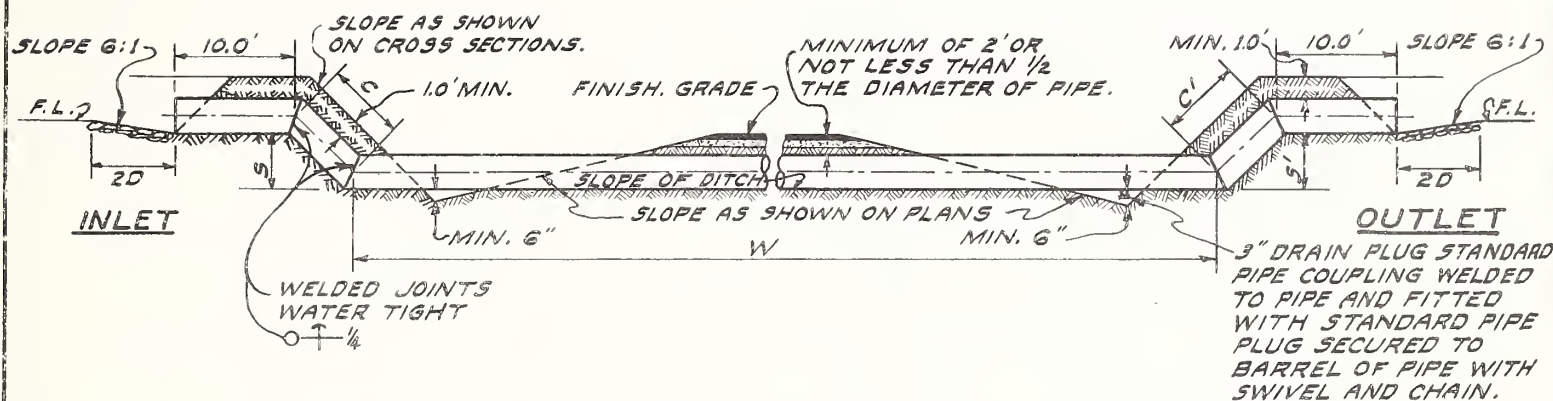
STANDARD DRAWING NO. 56 - 05

State Highway Commission
Helena, Montana

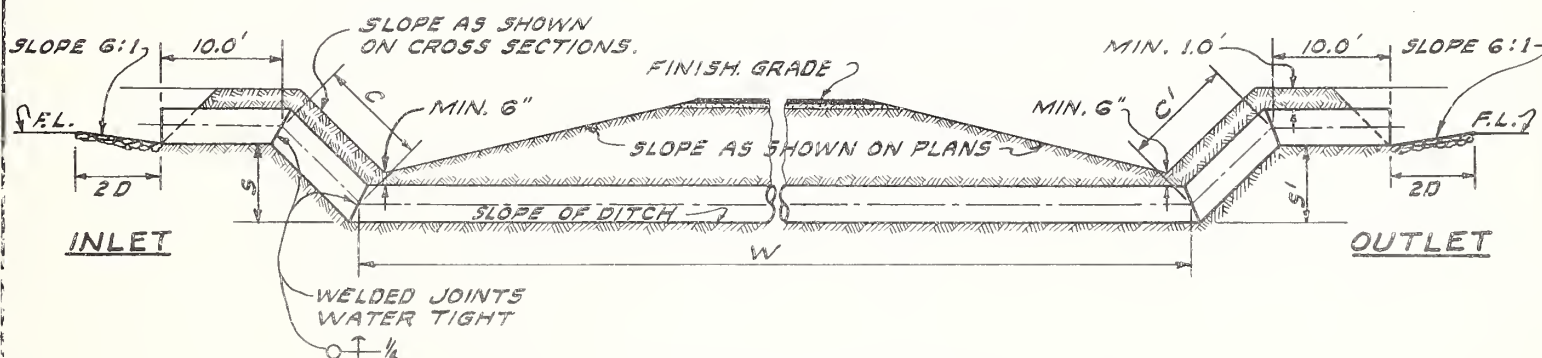
CORRUGATED METAL PIPE SYPHON

Approved

Levin H. Butler 12-9-68
State Highway Engineer



INSTALLATION NO. 1



INSTALLATION NO. 2

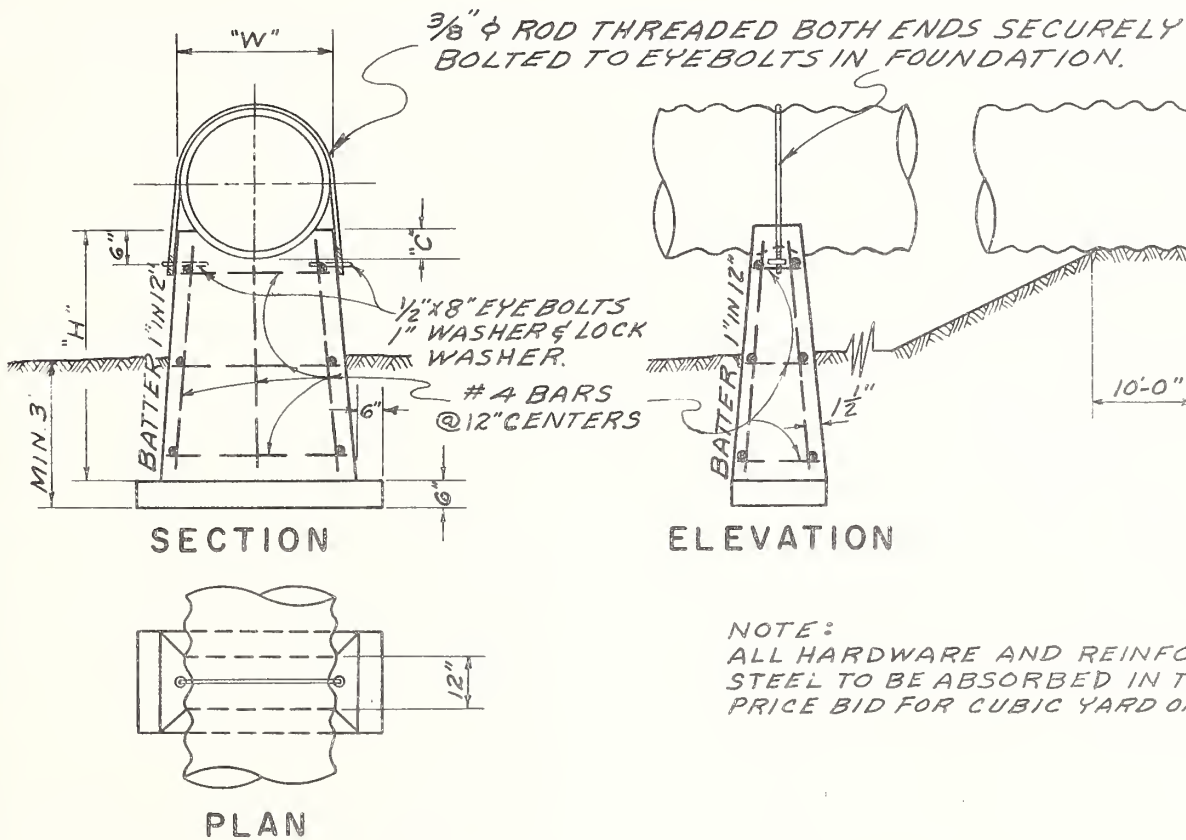
GENERAL NOTES

- ① - ANGLES OF ELBOWS MAY BE VARIED FOR SPECIAL INSTALLATIONS TO MAKE S OR S' FIT THE SITUATION. MAXIMUM S OR S' = 15.0'.
- ② - ANY AREA WHERE THE GALVANIZING MAY BE BROKEN OR DAMAGE DURING FABRICATION, SUCH AS AND INCLUDING WELDED JOINTS, SHALL BE COATED WITH BITUMINOUS MATERIAL CONFORMING TO AASHTO M 190.
- ③ - FIELD CONNECTIONS WILL NOT BE ALLOWED WITHIN FIFTEEN (15) FEET OF THE CENTERLINE OF THE ROAD.
- ④ - LENGTH OF SYPHON PIPE = $W + C + C' + 20.0'$
 W = SCALED FROM CROSS SECTION.
 L = AS CALLED FOR ON PLANS.
 C & C' = CENTERLINE MEASUREMENT ON SLOPE.
- ⑤ - PAYMENT FOR PIPE TO BE MADE FOR LENGTH MEASURED ALONG BOTTOM OR FLOW LINE OF PIPE.
- ⑥ - HEADWALLS - STD. DWG. NO. 73-05 (NOT TO BE USED UNLESS SHOWN ON PLANS)
- ⑦ - WHERE S OR S' IS TOO SHORT TO FABRICATE OR INSTALL BECAUSE OF THE RELATION OF THE DITCH GRADE TO THE ROAD DITCH GRADE OR ROADWAY GRADE INSTALLATION NO. 1 CANNOT BE USED.

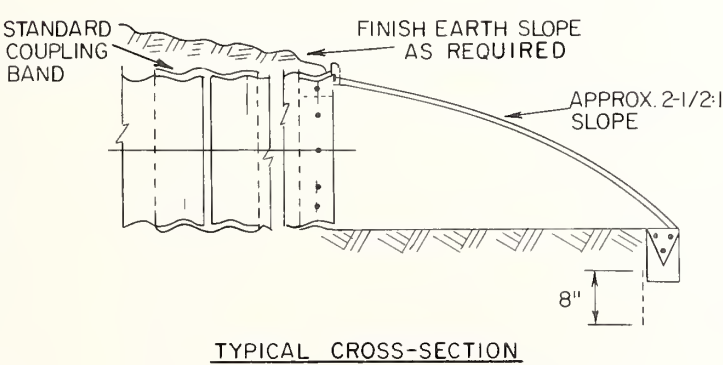
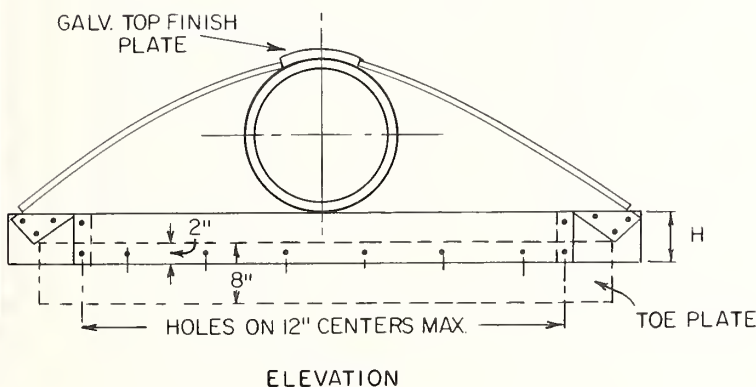
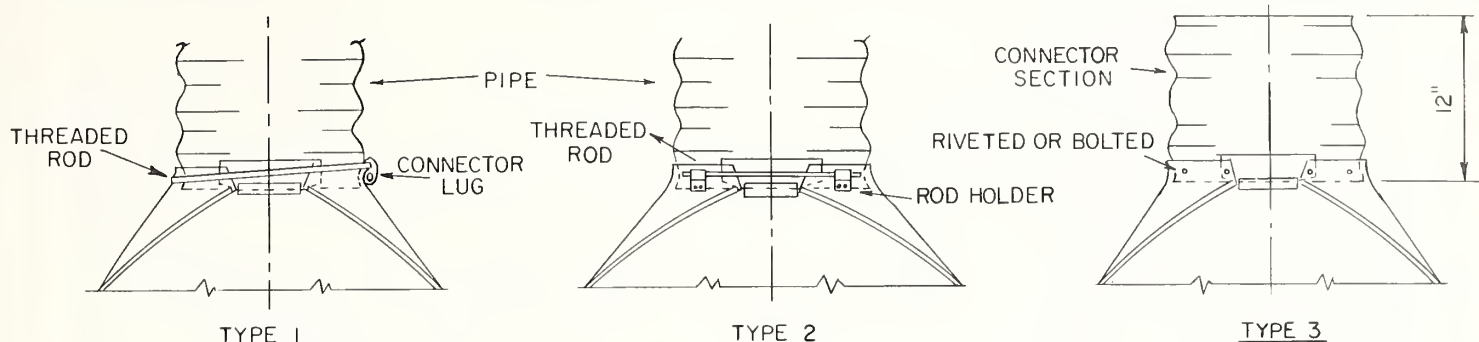
State Highway Commission
Helena, Montana

SUPPORTS FOR CORRUGATED METAL PIPES.

Approved
James M. Patton 12-9-68
State Highway Engineer

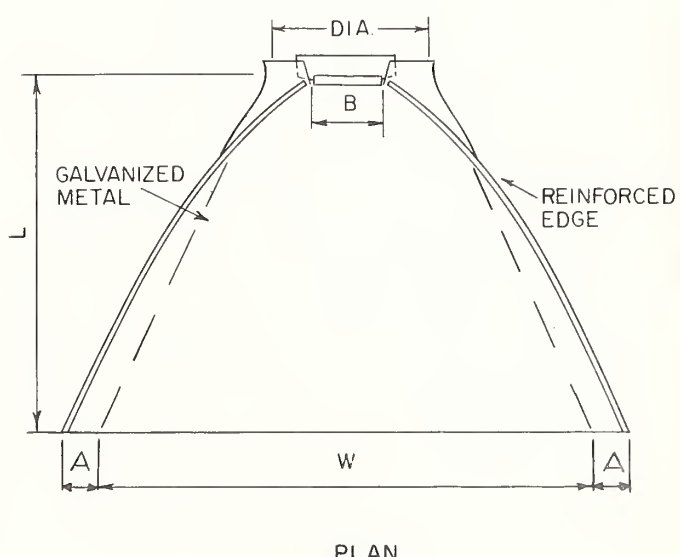


DIAMETER OF PIPE	MAX. SPAN OF PIPE C. TO C. OF SUPPORTS	"W"	"C"	CUBIC YARDS CLASS "DD" CONC. OR EQUAL IN ONE SUPPORT FOR DIFFERENT VALUE OF "H"					
				3'	4'	5'	6'	7'	8'
18"	20'	20"	3"	.35	.50	.67	.87	1.10	1.36
24"	18'	24"	4"	.40	.57	.76	.99	1.24	1.54
30"	16'	30"	5"	.48	.67	.90	1.17	1.46	1.80
36"	16'	36"	6"	.55	.78	1.04	1.34	1.68	2.06
42"	14'	42"	7"	.62	.88	1.18	1.52	1.89	2.31
48"	12'	48"	8"	.69	.99	1.32	1.69	2.11	2.57



(ILLUSTRATED WITH TYPE 3 CONNECTION)

PIPE DIAM	MIN. THICK- NESS	DIMENSIONS					Type Connector
		A 1" Tol	B Max.	H 1" Tol	L 1 1/2" Tol	W 2" Tol	
12"	0.064	6	6"	6"	21"	24"	1,3
15"	0.064	7	8	6	26	30	1,3
18"	0.064	8	10	6	31	36	1,3
21"	0.064	9	12	6	36	42	1,3
24"	0.064	10	13	6	41	48	1,3
30"	0.079	12	16	8	51	60	3,4
36"	0.079	14	19	9	60	72	3,4
42"	0.109	16	22	11	69	84	3,4
48"	0.109	18	27	12	78	90	3,4



Flared end terminal section to be included in length of pipe shown on plans.

All parts are to be galvanized in accordance with AASHO M 36.

Any areas where galvanizing is broken or metal is bare shall be painted with one coat of red lead or zinc chromate prime and two coats of aluminum paint.

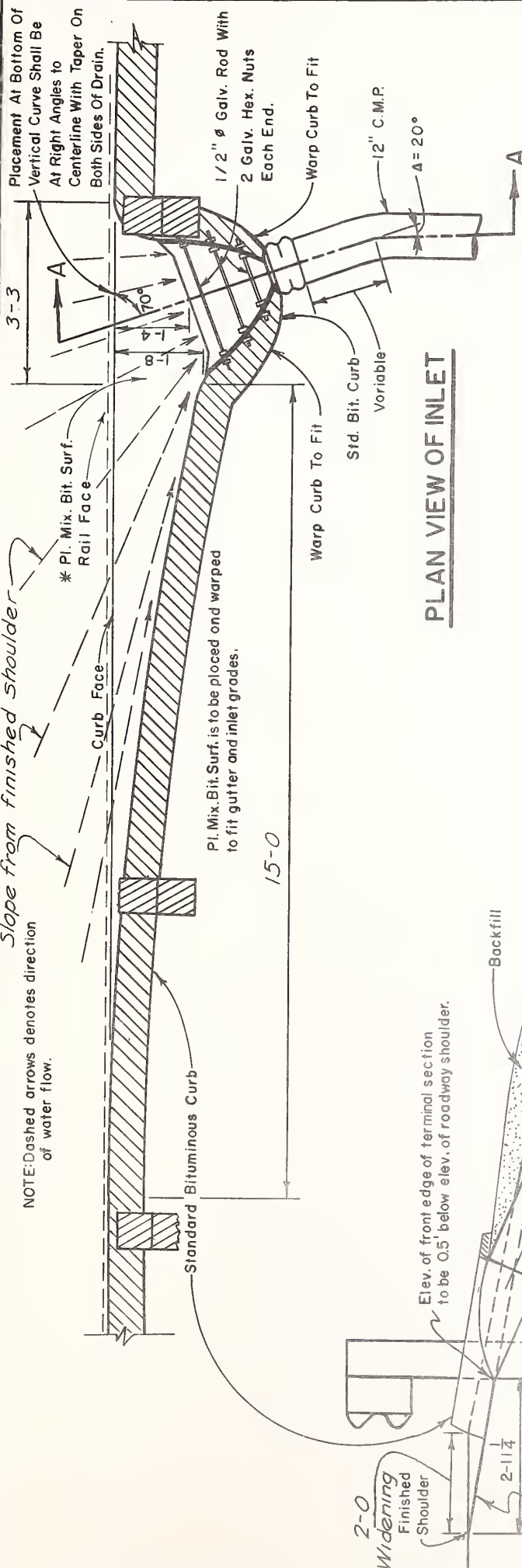
Minor variations in design may be acceptable on approval of the engineer. Seams or joints lengthwise of the apron will be acceptable if securely bolted, welded and painted as provided above.

The metal thickness shall be the same as the pipe to which the section is fastened.

State Highway Commission
Helena, Montana

EMBANKMENT PROTECTOR

Approved
James M. Phillips 10-9-67
State Highway Engineer



PLAN VIEW OF INLET

SECTION A-A

GENERAL NOTES

- Conduit May Be Either Circumferential Or Helical.
- θ And Δ Shall Be As Shown Unless Otherwise Specified In The Plans Or By The Engineer.
- Contractor Shall Not Order Pipe Until Directed By The Engineer.
- Flared End Section May Be Called For On Outlet End When Specified On Plans.
- Embankment Protector Shall Be Bid As Unit Price Bid Per Lin. Ft.
- The 12" Flared End Section, 12" C.M.P. And Bends, Are To Be Included In Total Length Of Embankment Protector.
- All Other Hardware Shall Be Included In The Unit Price Bid Per Lin. Ft. Of Embankment Protector.
- * Included With Roadway Quantities.

Approx. 1 1/2 Cu. Yd. Type 3 Bank Protection-- To Be Placed In Manner Best Suited To Fit Existing Conditions.

OUTLET DETAIL

REVISED			STANDARD DRAWING NO. 57-00
EFFECTIVE	1-1-71		
STATE HIGHWAY COMMISSION		FILL HEIGHT FOR C.S.P. ARCH	APPROVED
HELENA, MONTANA		3"X1" CORRUGATIONS	<i>Lucretia M. Phillips</i> STATE HIGHWAY ENGINEER

CORRUGATED STEEL PIPE ARCHES, 3-INCH BY 1-INCH CORRUGATIONS, RIVETED, WELDED, OR HELICAL FABRICATION, H-20 LOADING.

PIPE DIMENSIONS SPAN X RISE (INCHES)	AREA (SQ. FT.)	CORNER RADIUS INCHES	MINIMUM COVER INCHES	MINIMUM THICKNESS REQUIRED (INCHES)	MAXIMUM FILL HEIGHTS (FEET)
					CORNER BEARING PRESSURE 2-TONS / SQ. FT.
43 X 27	6.4	7 3/4	18	0.064	12
50 X 31	8.7	9	18	0.064	12
58 X 36	11.4	10 1/2	18	0.064	12
65 X 40	14.3	12	18	0.064	12
72 X 44	17.6	13 1/4	18	0.064	12
73 X 55	21.3	18	18	0.064	15 +
81 X 59	25.3	18	18	0.079	15
87 X 63	31.0	18	18	0.079	14
95 X 67	35.0	18	18	0.109	13
103 X 71	40.0	18	24	0.109	12
112 X 75	46.0	18	24	0.109	11
117 X 79	52.0	18	24	0.109	10
128 X 83	58.0	18	24	0.138	9

NOTES: WHERE BEARING PRESSURES EXCEEDING 2 TONS PER SQUARE FOOT ARE REQUIRED FOR GIVEN FILL HEIGHT, THE FOUNDATION MATERIAL SHALL BE INVESTIGATED TO DETERMINE ITS BEARING CAPACITY.

IF SKEW IS REQUIRED SEE STD. DWG. NO. 56-01.

SEE STD. DWG. NO. 56-02 FOR GALVANIZED STEEL THICKNESS AND GAGE TABLE.

REVISED				STANDARD DRAWING NO. 57-01
EFFECTIVE	1-1-71			
STATE HIGHWAY COMMISSION		FILL HEIGHT FOR C.S.P. ARCH		APPROVED
HELENA, MONTANA		2 ² / ₃ "X ¹ / ₂ " CORRUGATIONS		<i>James M. Fulton</i>
				STATE HIGHWAY ENGINEER

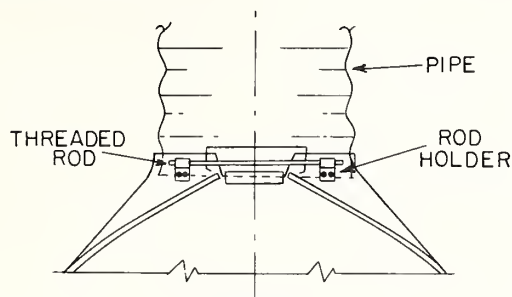
FOR CORRUGATED STEEL PIPE ARCHES, 2²/₃-INCH BY ¹/₂ INCH CORRUGATIONS, RIVETED, WELDED, OR HELICAL FABRICATION, H-20 LOADING.

PIPE DIMENSIONS SPAN X RISE (INCHES)	AREA (SQ. FT.)	CORNER RADIUS (INCHES)	MINIMUM COVER (INCHES)	MINIMUM THICKNESS REQUIRED (INCHES)	MAXIMUM FILL HEIGHTS (FEET)
					CORNER BEARING PRESSURE 2 TONS / SQ. FT.
18X11	1.1	3 ¹ / ₂	18	0.064	13
22X13	1.6	4	18	0.064	12
25X16	2.2	4	18	0.064	10
29X18	2.8	4 ¹ / ₂	18	0.064	10
36X22	4.4	5	18	0.064	9
43X27	6.4	5 ¹ / ₂	18	0.064	9
50X31	8.7	6	18	0.079	8
58X36	11.4	7	18	0.109	8
65X40	14.3	8	18	0.109	8
72X44	17.6	9	18	0.138	8
79X49	21.3	10	18	0.168	8
85X54	25.3	11	18	0.168	9

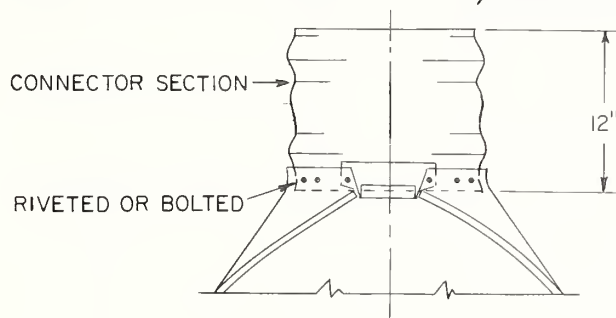
NOTES: WHERE BEARING PRESSURES EXCEEDING 2 TONS PER SQUARE FOOT ARE REQUIRED FOR GIVEN FULL HEIGHT, THE FOUNDATION MATERIAL SHALL BE INVESTIGATED TO DETERMINE ITS BEARING CAPACITY.

IF SKEW IS REQUIRED SEE STD. DWG. NO. 56-01.

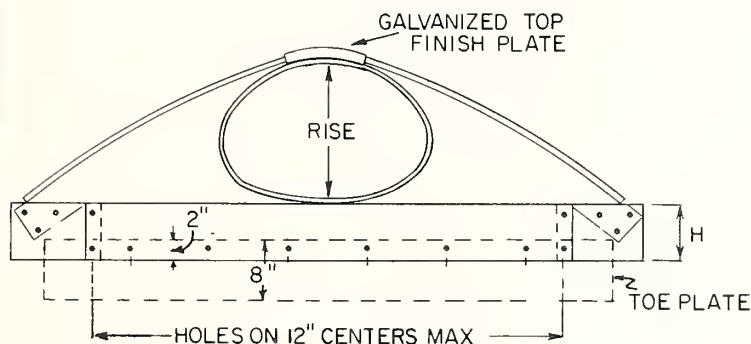
SEE STD. DWG. NO. 56-02 FOR GALVANIZED STEEL THICKNESS AND GAGE TABLE.



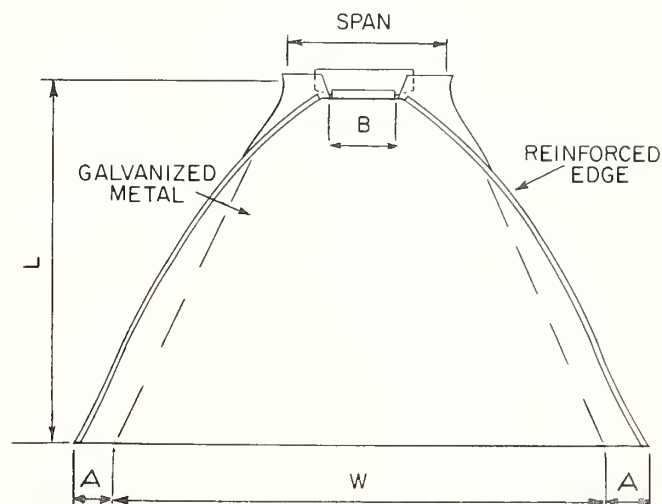
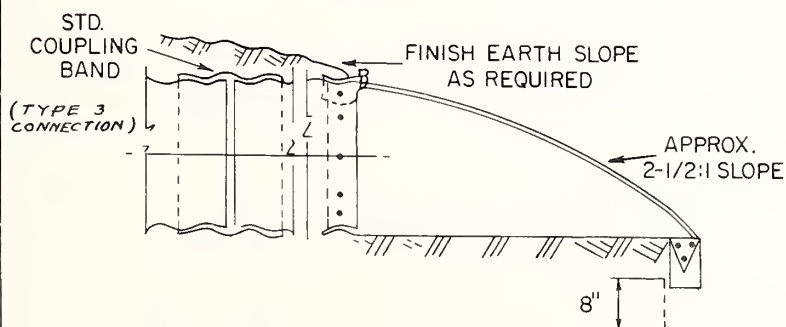
TYPE #2



TYPE #3



ELEVATION



PLAN

PIPE-ARCH DIMENSION		MIN. THICKNESS	DIMENSIONS					*
SPAN	RISE		A 1" Tol	B Max.	H 1" Tol	L 1½" Tol	W 2" Tol	
18	11	0.064	7	9"	6"	19"	30"	123
22	13	0.064	7	10	6	23	36	123
25	16	0.064	8	12	6	28	42	123
29	18	0.064	9	14	6	32	48	123
36	22	0.079	10	16	6	39	60	123
43	27	0.079	12	18	8	46	75	123
50	31	0.109	13	21	9	53	85	123
58	36	0.109	18	26	12	63	90	3
65	40	0.109	18	30	12	70	102	3
72	44	0.109	18	33	12	77	114	3
79	49	0.109	18	36	12	77	126	3
85	54	0.109	18	36	12	77	138	3

Flared end terminal section to be included in length of pipe shown on plans.

All parts are to be galvanized in accordance with AASHO M 36.

Any areas where galvanizing is broken or metal is bare shall be painted with one coat of red lead or zinc chromate prime and two coats of aluminum paint.

***Type connector - See STD. DWG. #56-07 for type 1 connector.**

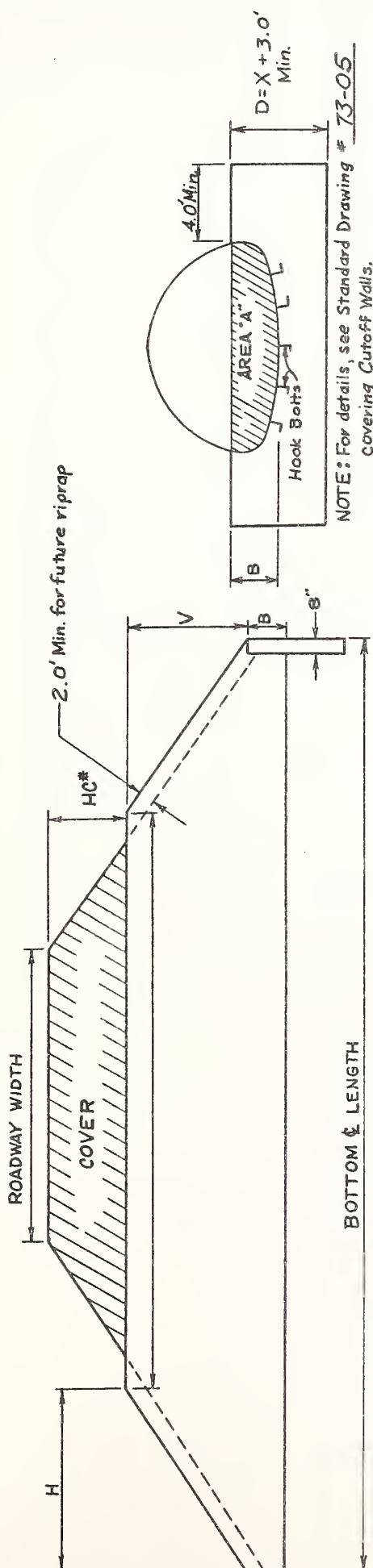
Minor variations in design may be acceptable on approval of the engineer. Seams or joints lengthwise of the apron will be acceptable if securely bolted, welded and painted as provided above.

The metal thicknesses shall be the same as the pipe to which the section is fastened.

State Highway Commission
Helena, Montana

BEVEL ON CORRUGATED STEEL PIPE ARCH

Approved,
Louis M. Sullivan
State Highway Engineer



Tolerance of $\pm 4\%$ will be allowed in all dimensions.

Use skew ends when skew is greater than 15° but not greater than 45° .

* HC = See Std. Dwg. No. 57-01

H/C measured vertically from finished low shoulder to top of pipe. If possible it is desirable that top of pipe be placed a min. of 1.0' below subgrade surface.

SPAN (Inches)	RISE (Inches)	EQUIV. (Dia)	H for Bevels of		V	B	Area "A"
			1/2 in	2:1			
3 by 1 inch Corrugation							
58	36	48	34 1/2	46	23	13	4.4
65	40	54	37 7/8	50 1/2	25 1/4	14 3/4	5.6
72	44	60	41 5/8	55 1/2	27 3/4	16 1/4	6.7
73	55	66	51	68	34	21	8.7
81	59	72	56 1/4	75	37 1/2	21 1/2	10.0
87	63	78	61 1/2	82	41	22	10.9
95	67	84	66 3/4	89	44 1/2	22 1/2	12.1
103	71	90	72	96	48	23	13.5
112	75	96	77 1/4	103	51 1/2	23 1/2	15.0
117	79	102	82 1/2	110	55	24	16.1
128	83	108	87 3/4	117	58 1/2	24 1/2	18.2
2 1/2 by 1 1/2 inch Corrugation							
58	36	48	40 1/8	53 1/2	26 3/4	9 1/4	3.1
65	40	54	44 1/4	59	29 1/2	10 1/2	3.9
72	44	60	48 3/8	64 1/2	32 1/4	11 3/4	5.0
79	49	66	53 5/8	71 1/2	35 3/4	13 1/4	6.1
85	54	72	59 1/4	79	39 1/2	14 1/2	7.3

REVISED		2-25-71		STANDARD DRAWING NO. 59-00
EFFECTIVE	1-1-71	3-1-71		
STATE HIGHWAY COMMISSION		FILL HEIGHT FOR S.S.P.P H-20 LOADING 6"X2" CORRUGATIONS		APPROVED <i>James M. Sullivan</i> STATE HIGHWAY ENGINEER
HELENA, MONTANA				

FOR STEEL STRUCTURAL PLATE PIPE, 6-INCH BY 2-INCH CORRUGATIONS, BOLTED FABRICATION, H-20 LOADING.

PIPE DIAMETER IN INCHES	MINIMUM COVER TOP OF PIPE TO TOP OF SUBGRADE (INCHES)	MAXIMUM FILL HEIGHTS ABOVE TOP OF PIPE IN FEET						
		METAL THICKNESS IN INCHES						
		0.109	0.138	0.168	0.188	0.218	0.249	0.280
60	12	43	62	81	93	106(111)	116(132)	126(144)
72	12	36	52	68	73(78)	79(93)	85(110)	91(120)
84	12	31	44	58	61(67)	65(79)	69(94)	72(103)
96	12	27	39	51	55(58)	57(69)	60(82)	62(90)
108	24	24	34	45	50	52(62)	54(73)	56(80)
120	24	22	31	41	47	49(56)	50(66)	52(72)
132	24	20	28	37	42	47(51)	48(60)	49(66)
144	24	18	26	34	39	45	46(55)	47(60)
156	24	17	24	31	36	43	45(50)	46(56)
168	24	15	22	29	33	40	44(47)	45(52)
180	24	14	21	27	31	37	44	44(48)
192	24		19	25	29	35	41	43
204	36		18	24	27	33	39	43
216	36			23	26	31	37	40
228	36			21	25	29	35	38
240	36				23	28	33	36
252	36					27	31	34

NOTES: VALUES FOR ELONGATED PIPE ARE SHOWN IN PARENTHESIS.

USE SPECIAL DESIGN FOR STRUCTURES WITH HEIGHTS OF COVER EXCEEDING THESE TABLES.

IF SKEW IS REQUIRED SEE STD. DWG. NO. 56-01.

SEE STD. DWG. 56-02 FOR GALVANIZED STEEL THICKNESS AND GAGE TABLE.

PIPE DIAMETER (INCHES)	60	72	84	96	108	120	132	144	156	168	180	192	204	216	228	240	252
AREA (SQ. FT.)	19.6	28.3	38.5	50.3	63.6	78.5	95.0	113.1	132.7	153.9	176.7	201.1	227.0	254.5	283.5	314.2	346.4

REVISED		2-25-71		STANDARD DRAWING NO. 59-01
EFFECTIVE	1-1-71	3-1-71		
STATE HIGHWAY COMMISSION		FILL HEIGHT FOR S.S.P.P. ARCH		APPROVED
HELENA, MONTANA		6"X2" CORRUGATIONS		<i>L. M. Sullivan</i>
				STATE HIGHWAY ENGINEER

FOR STEEL STRUCTURAL PLATE PIPE ARCHES, 6-INCH BY 2-INCH CORRUGATIONS, BOLTED, FABRICATION, H-20 LOADING.

PIPE DIMENSIONS SPAN X RISE (FT.-IN.)	AREA (SQ. FT.)	CORNER RADIUS (INCHES)	MINIMUM COVER (INCHES)	MINIMUM THICKNESS REQUIRED (INCHES)	MAXIMUM FILL HEIGHTS (FEET)
					CORNER BEARING PRESSURE 2 TONS/ SQ.FT.
6'-1" X 4'-7"	22	18	18	0.109	15
7'-0" X 5'-1"	28	18	18	0.109	15
7'-11" X 5'-7"	35	18	18	0.109	12
8'-10" X 6'-1"	43	18	24	0.109	11
9'-9" X 6'-7"	52	18	24	0.109	10
10'-11" X 7'-1"	61	18	24	0.109	9
11'-10" X 7'-7"	71	18	24	0.109	8
12'-10" X 8'-4"	85	18	24	0.109	8
13'-3" X 9'-4"	98	31	24	0.109	13
14'-2" X 9'-10"	110	31	24	0.109	12
15'-4" X 10'-4"	124	31	24	0.138	11
16'-3" X 10'-10"	138	31	36	0.138	11
17'-2" X 11'-4"	153	31	36	0.138	11
18'-1" X 11'-10"	168	31	36	0.168	9
19'-3" X 12'-4"	185	31	36	0.168	9
19'-11" X 12'-10"	202	31	36	0.168	8
20'-7" X 13'-2"	214	31	36	0.188	8

NOTES: WHERE BEARING PRESSURES EXCEEDING 2 TONS PER SQUARE FOOT ARE REQUIRED FOR GIVEN FILL HEIGHT, THE FOUNDATION MATERIAL SHALL BE INVESTIGATED TO DETERMINE ITS BEARING CAPACITY.

IF SKEW IS REQUIRED SEE STD. DWG. NO. 56-01.

SEE STD. DWG. NO. 56-02 FOR GALVANIZED STEEL THICKNESS AND GAGE TABLE.

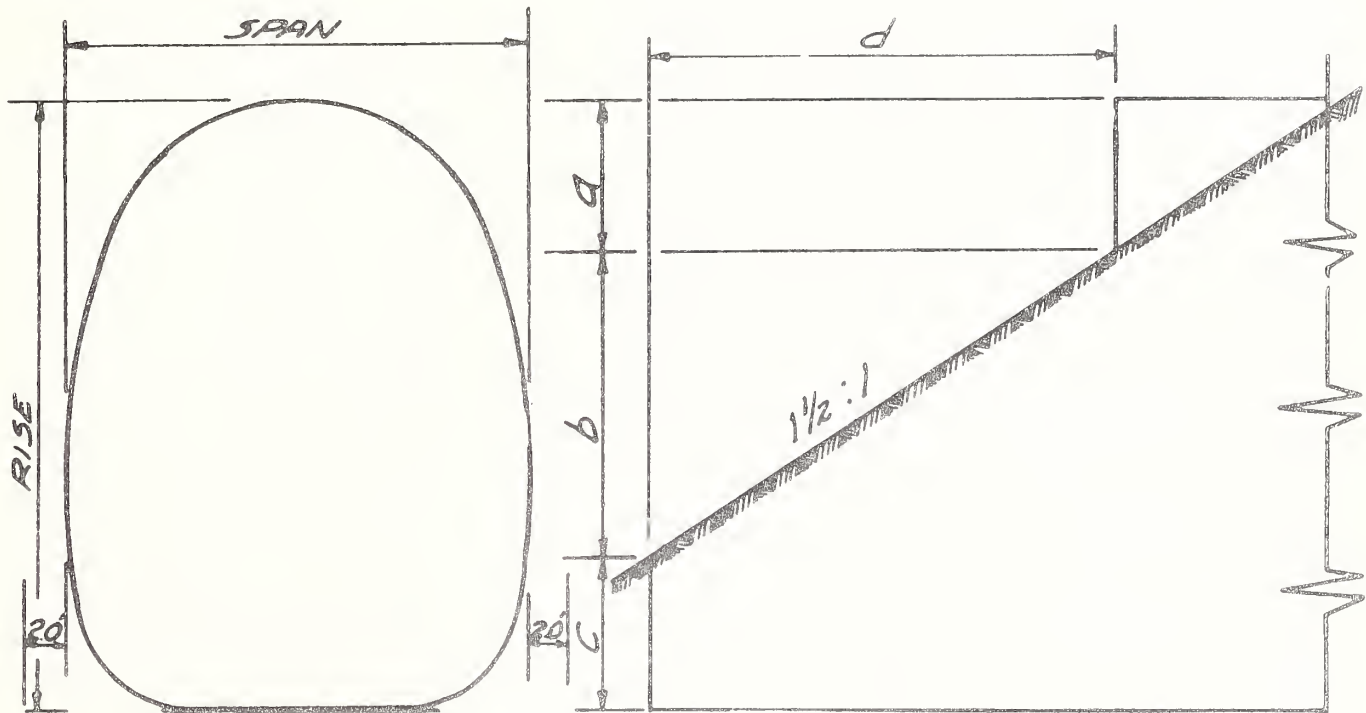
REVISED	4-1-65	11-20-68
EFFECTIVE	4-1-65	1-1-69

STANDARD DRAWING NO. 59-02

State Highway Commission
Helena, Montana

STRUCTURAL PLATE PIPE STOCKPASS

Approved
Levin's Highway 12-8-68
State Highway Engineer



DIMENSIONS

DESIGN	SPAN	RISE	GAGE	a *	b *	c *	d *
A	5'-10"	6'-6"	10	1'-8"	3'-10"	1'-8"	5'-9"
B	5'-10"	7'-7"	10	1'-8"	4'-7"	1'-8"	6'-10"

DESIGN "A" STOCKPASS: THE TOP OF THE STOCKPASS SHALL BE AN ARC HAVING A RADIUS OF NOT LESS THAN 26 INCHES OR MORE THAN 30 INCHES AND SHALL NOT BE LESS THAN 100° OR MORE THAN 130°. THE SIDES SHALL BE ARCS HAVING A RADIUS OF NOT LESS THAN 60 INCHES OR MORE THAN 72 INCHES. CORNERS SHALL BE ARCS HAVING A RADIUS OF NOT LESS THAN 17 INCHES OR MORE THAN 20 INCHES. THE BOTTOM SHALL BE A FLAT SEGMENT NOT LESS THAN 29 INCHES OR MORE THAN 34 INCHES IN WIDTH.

DESIGN "B" STOCKPASS: THE TOP OF THE STOCKPASS SHALL BE AN ARC HAVING A RADIUS OF NOT LESS THAN 24 INCHES OR MORE THAN 30 INCHES AND SHALL NOT BE LESS THAN 110° OR MORE THAN 145°. THE SIDES SHALL BE ARCS HAVING A RADIUS OF NOT LESS THAN 85 INCHES OR MORE THAN 112 INCHES. CORNERS SHALL BE ARCS HAVING A RADIUS OF NOT LESS THAN 17 INCHES OR MORE THAN 20 INCHES. THE BOTTOM SHALL BE A FLAT SEGMENT NOT LESS THAN 29 INCHES OR MORE THAN 34 INCHES IN WIDTH.

* FOR DESIGN PURPOSES ONLY. BEVELING SHALL COMMENCE AT THE BOTTOM OF THE TOP PLATE AND EXTEND DOWNWARD ON A 1 1/2:1 SLOPE TO THE TOP OF THE CORNER PLATE.

A TOLERANCE OF ± 4% IN SPAN AND RISE WILL BE ACCEPTABLE.

THE LENGTH SHALL BE MEASURED ALONG THE FLOW LINE OF THE STOCKPASS, END TO END OF STRUCTURE.

UNLESS OTHERWISE CALLED FOR, END PLATES SHALL BE BEVELED AS SHOWN ABOVE, AND SHALL BE MEASURED AND PAID FOR AT THE UNIT PRICE BID PER LINEAL FOOT OF STRUCTURAL PLATE PIPE STOCKPASS. WHEN ENDS ARE BEVELED, THE ANGLE OF SKEW SHALL NOT EXCEED 15° UNLESS OTHERWISE NOTED.

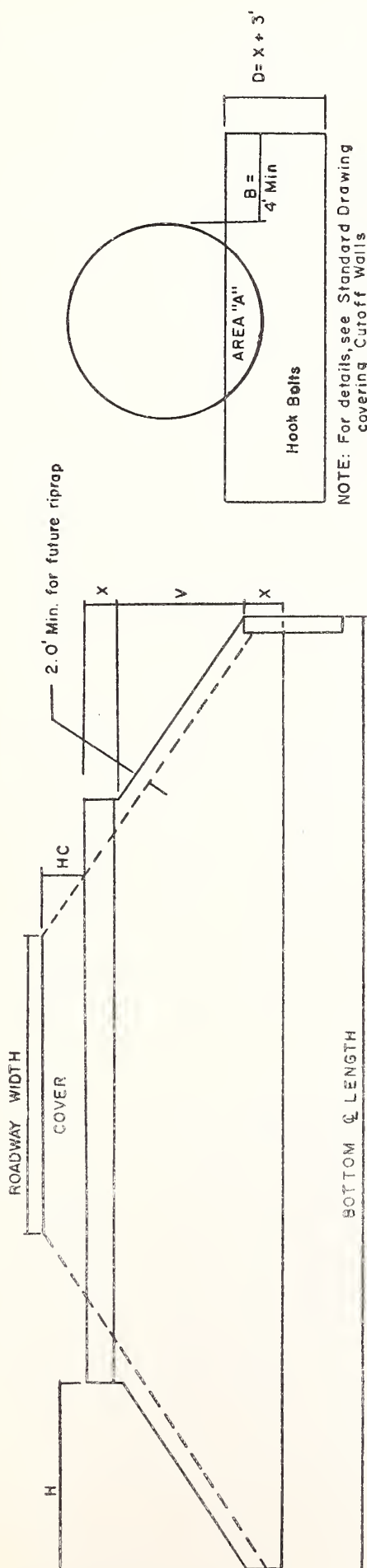
SEE STANDARD DRAWINGS CONCERNING BEDDING MATERIAL BENEATH THE STRUCTURE.

SEE STANDARD DRAWINGS CONCERNING RIPRAP WHEN TOE PROTECTION IS NECESSARY.

MINIMUM COVER = 2.0 ft. TO FINISH GRADE.

MAXIMUM COVER = 6.0 ft. TO FINISH GRADE.

FILL SLOPES SHALL BE WARPED A MINIMUM OF 25.0° ON EACH SIDE OF THE STOCKPASS TO FIT THE END BEVEL.



NOTE: See applicable Standard Drawing of Thickness Tables for Maximum & Minimum Height of Cover.

Dia (In)	X* (Ft.)	H' in feet for bevels of:		V* (Ft.)	Area 'A' Sq. Ft.
		15:1	2:1		
48	1.000	3.000	4.000	2.000	2.46
54	1.125	3.375	4.500	2.250	3.11
60	1.250	3.750	5.000	2.500	3.83
66	1.375	4.125	5.500	2.750	4.44
72	1.500	4.500	6.000	3.000	5.53
78	1.625	4.875	6.500	3.250	6.61
84	1.750	5.250	7.000	3.500	7.51
90	1.875	5.625	7.500	3.750	8.61
96	2.000	6.000	8.000	4.000	9.81
102	2.125	6.375	8.500	4.250	11.08
108	2.250	6.750	9.000	4.500	12.42
114	2.375	7.125	9.500	4.750	13.84
120	2.500	7.500	10.000	5.000	15.38
126	2.625	7.875	10.500	5.250	16.98
132	2.750	8.250	11.000	5.500	18.50

Dia (In)	X* (Ft.)	H in feet for bevels of:		V* (Ft.)	Area 'A' Sq. Ft.
		15:1	2:1		
138	2.875	8.625	11.500	5.750	20.30
144	3.000	9.000	12.000	6.000	22.10
150	3.125	9.375	12.500	6.250	24.00
156	3.250	9.750	13.000	6.500	25.9
162	3.375	10.125	13.500	6.750	27.9
168	3.500	10.500	14.000	7.000	30.1
174	3.625	10.875	14.500	7.250	32.2
180	3.750	11.250	15.000	7.500	34.5
192	4.000	12.000	16.000	8.000	39.3
198	4.125	12.375	16.500	8.250	41.7
204	4.250	12.750	17.000	8.500	44.2
210	4.375	13.125	17.500	8.750	46.9
216	4.500	13.500	18.000	9.000	49.7
228	4.750	14.250	19.000	9.500	55.5
240	5.000	15.000	20.000	10.000	61.5
252	5.250	15.750	21.000	10.500	67.7

Tolerance of $\pm 4\%$ will be allowed in all dimensions.
Use skew ends when skew is greater than 15° but not greater than 45° .
*For elliptical pipe, increase vertical dimensions by percent of ellipse.

REVISED
EFFECTIVE 4-1-70

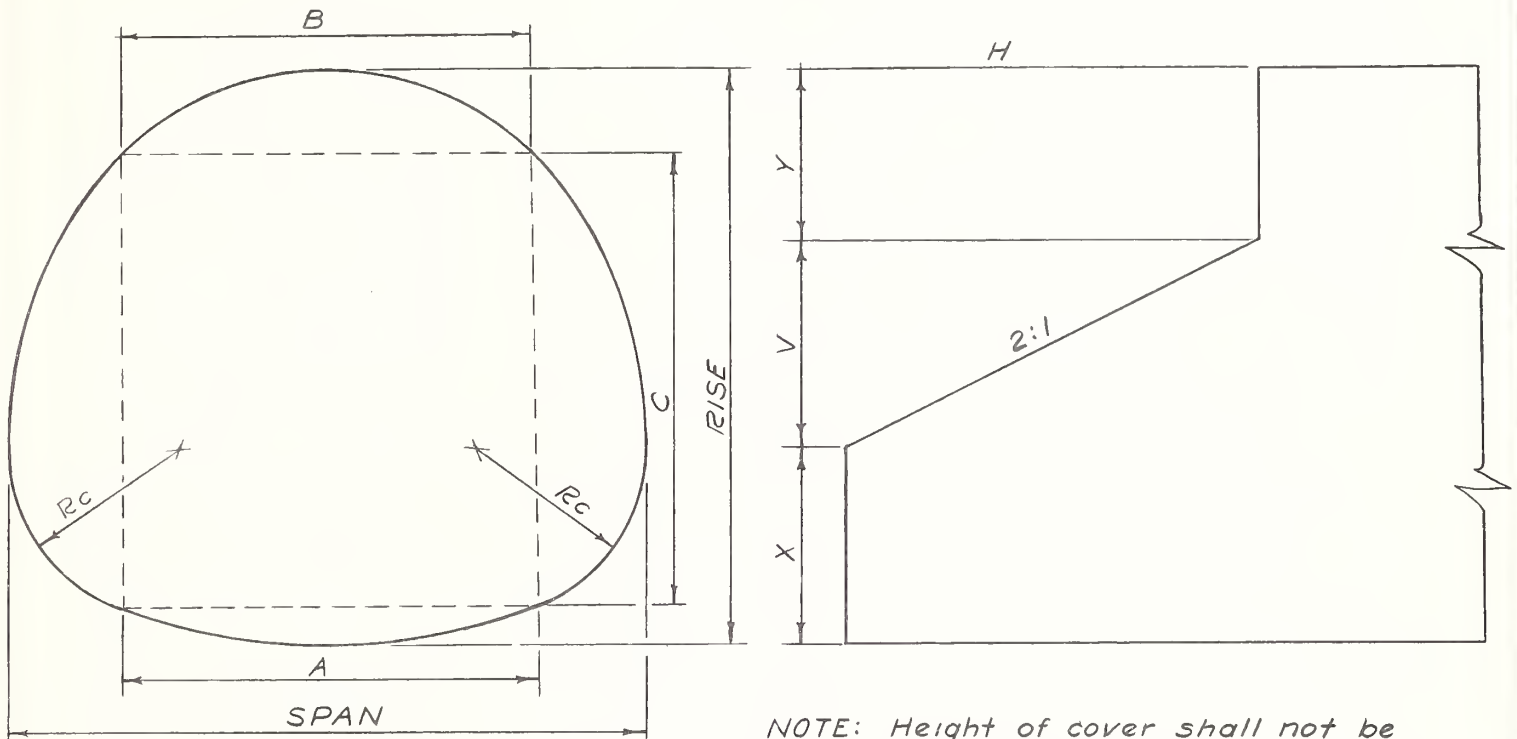
STANDARD DRAWING NO. 59-04

STATE HIGHWAY COMMISSION
HELENA, MONTANA

VEHICULAR UNDERPASS

Approved
Lewis M. Chittick 8/31/70
State Highway Engineer

NOTE: Structures of a similar design may be used if approved by the engineer.

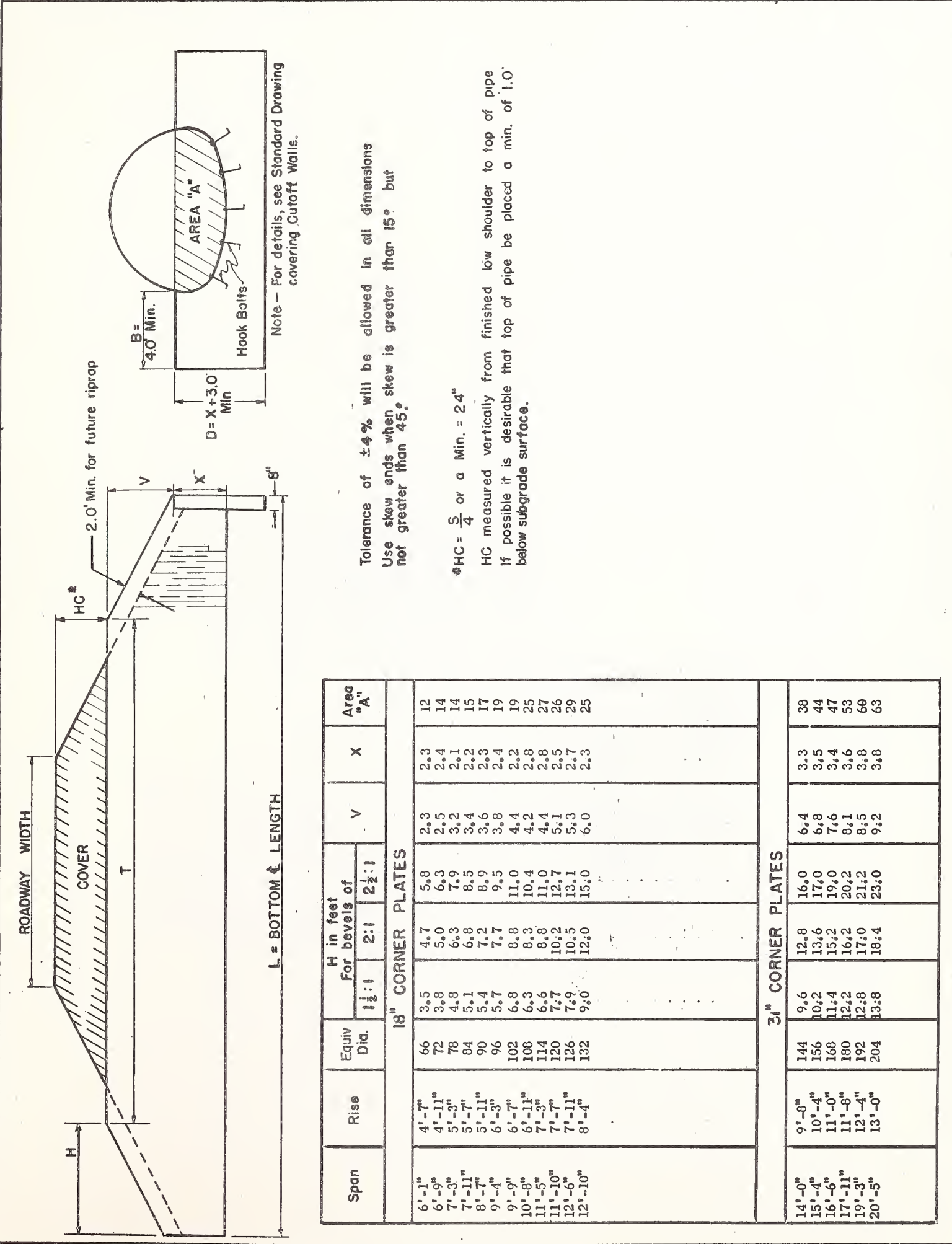


NOTE: Height of cover shall not be less than 5.0 feet.

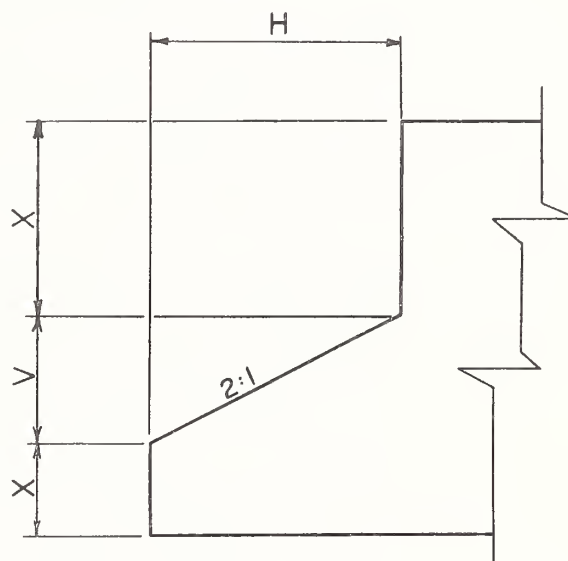
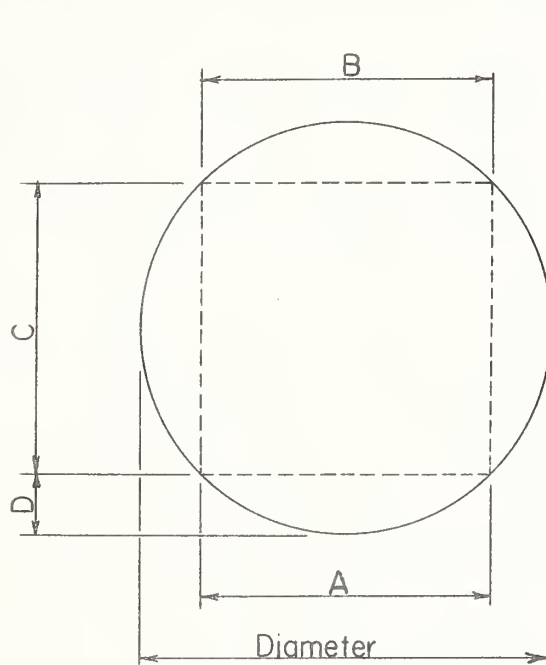
SPAN (ft.-in.)	RISE (ft.-in.)	A (ft.)	B (ft.)	C (ft.)	H (ft.)	V (ft.)	X (ft.-in.)	Y (ft.-in.)
12-2	11-0	10	8	8	10	5	3-8.4	2-3.6
13-10	12-2	10	8	10	10	5	3-10	3-4
14-10	14-0	12	10	10.5	10	5	3-10.4	5-1.6
15-8	15-0	12	10	12	10	5	3-11	6-1
16-5	16-0	12	10	13	12	6	3-7.5	6-4.5
17-3	17-0	12	10	14	12	6	4-8.7	6-3.3
19-1	17-2	16	12	13	12	6	4-9.6	6-4.4
20-4	17-9	16	12	14	12	6	4-9.3	6-11.7

SPAN (ft.-in.)	RISE (ft.-in.)	RADIUS Rc (in.)	MAXIMUM HEIGHT OF COVER IN FEET					
			10 GAGE	8 GAGE	7 GAGE	5 GAGE	3 GAGE	1 GAGE
12-2	11-0	38	17	19	20	22	25	27
13-10	12-2	38	15	17	18	20	21	23
14-10	14-0	38	14	15	16	18	20	22
15-8	15-0	38	13	14	15	17	19	21
16-5	16-0	38	12	12	13	14	15	16
17-3	17-0	47	11	12	12	13	14	15
19-1	17-2	47	10	10	11	12	13	14
20-4	17-9	47	9	10	10	11	12	13

NOTE: These structures will be designated, in plans and proposal, as "Vehicular Underpass". Materials, installation and other provisions shall conform to the standard specifications.
The term "Vehicular Underpass" will be used, regardless of the use or purpose of the structure.



REVISED	6-16-67	11-20-68	STANDARD DRAWING NO. 59-06
EFFECTIVE	8-1-67	1-1-69	
State Highway Commission		CIRCULAR VEHICLE UNDERPASS STRUCTURAL PLATE PIPE	
Helena, Montana		Approved <i>James M. Sullivan</i> State Highway Engineer	



NOTE: WHERE CROSS DRAINAGE AND VEHICULAR TRAFFIC ARE COMBINED, USE STANDARD DRAWING NO. 51-03 IN ADDITION TO THIS STANDARD DRAWING.

SEE STANDARD DRAWING NO. 59-01 FOR MINIMUM & MAXIMUM HEIGHT OF COVER.

DIA. (INCHES)	A	B	C	D	H	V	X
102	4'-10"	4'-10"	7'-0"	0.8'	8.5'	4.25'	2.125'
126	6'-7"	6'-7"	8'-2"	1.2'	10.5'	5.25'	2.625'
162	10'-0"	8'-6"	9'-10"	2.2'	13.5'	6.75'	3.375'
180	10'-0"	10'-0"	11'-2"	2.0'	15.0'	7.50'	3.750'
198	12'-0"	10'-0"	12'-3"	2.6'	16.5'	8.25'	4.125'
210	10'-0"	10'-0"	14'-4"	1.6'	17.5'	8.75'	4.375'

REVISED EFFECTIVE		2-1-64 2-1-64	11-20-68 1-1-69	STANDARD DRAWING NO. 62-01																		
State Highway Commission Helena, Montana			LOADING FOR ROUND R.C.P. CULVERTS												Approved <i>James G. Butler</i> 12-9-68 State Highway Engineer							
THIS TABLE NOT TO BE USED FOR DESIGN EXCEPT WHEN AUTHORIZED IN WRITING			THIS TABLE TO BE USED FOR DESIGN UNLESS DIRECTED OTHERWISE																			
PIPE CLASS BEDDING CLASS	CLASS 2				CLASS 3				CLASS 4				CLASS 5				PIPE DIAMETER INCHES	PROJ.	RATIO	*		
	A	B	D	Bi Ci	A	B	D	Bi Ci	A	B	D	Bi Ci	A	B	D	Bi Ci						
P *	0 10	0 07	0 10		0 10	0 07	0 10		0 10	0 07	0 10		0 10	0 07	0 10		0 09	0 09	0 09	0 09		
	21 16	14 10	7 5	29 22	28 23	19 15	10 8	40 33	41 31	27 22	15 11	57 45	63 46	41 32	22 16	85 68	12	12	9 16	13 23	17 34	26
	20 16	14 10	7 6	29 22	28 23	19 15	10 8	40 33	41 32	28 22	15 11	58 45	63 46	43 32	22 16	85 69	15	12	8 16	13 23	17 35	27
	20 16	14 11	7 6	29 23	28 23	20 15	10 8	40 33	43 32	28 22	15 11	59 46	63 46	43 32	23 16	85 70	18	12	9 16	13 23	17 35	26
	20 16	14 10	8 6	29 22	28 23	19 14	10 8	39 32	41 32	27 22	14 11	59 45	60 46	41 32	22 16	83 66	21	12	9 16	13 23	17 35	26
	21 16	14 11	7 6	29 22	28 23	19 14	10 8	40 33	42 32	28 22	15 11	58 46	62 47	42 33	22 16	86 69	24	12	9 16	13 23	18 35	26
	20 16	14 11	7 6	29 22	28 23	19 14	11 7	39 33	42 32	28 22	15 11	59 46	62 47	42 31	22 16	86 69	27	12	9 16	13 24	18 35	27
	21 16	14 11	7 6	28 22	28 23	19 14	10 7	39 32	42 33	29 22	15 12	58 46	62 48	43 33	22 17	85 69	30	12	9 16	13 24	18 35	27
	20 16	14 11	7 6	28 22	28 23	19 14	10 7	38 32	41 32	28 22	15 11	57 45	62 48	41 32	22 16	86 69	33	12	9 16	13 24	18 35	27
	20 16	14 11	7 6	29 22	29 23	19 14	10 7	38 32	41 32	29 22	15 11	58 45	61 47	42 32	22 17	87 69	36	12	9 16	12 23	17 34	26
	20 17	14 11	8 6	28 22	28 23	20 14	10 8	38 32	42 33	28 23	15 12	58 46	61 49	42 33	22 17	88 69	42	12	9 16	14 24	17 35	27
	21 17	14 11	8 7	28 21	28 23	19 14	10 9	38 31	43 33	29 22	15 12	58 45	62 48	42 33	23 17	87 69	48	11	10 16	13 24	18 35	28
	20 16	14 11	9 7	27 20	28 23	20 14	10 9	38 31	41 33	28 22	15 12	58 44	61 49	42 33	22 16	86 68	54	11	10 16	13 24	17 35	27
	20 16	14 11	8 7	27 19	28 22	19 14	10 9	38 31	42 33	29 23	15 12	58 44	62 48	42 35	23 17	86 69	60	11	10 16	13 24	18 35	28
	20 16	14 11	9 7	27 17	28 23	18 15	11 9	38 30	42 33	28 22	16 12	58 44	62 49	42 33	22 18	85 68	66	12	10 16	13 24	19 36	28
	19 17	14 11	9 7	27 18	29 23	19 16	11 9	38 31	43 33	29 23	16 12	57 45	63 49	43 33	22 19	86 69	72	12	10 16	14 24	19 35	28
	20 17	14 12	9 7	26 19	29 23	19 16	11 9	37 30	41 33	29 23	16 12	57 44					78	12	10 16	15 25	19	
	20 17	14 12	8 7	23 18	28 23	20 17	11 9	35 29	42 33	28 23	16 12	57 43					84	12	10 16	15 26	18	

THIS TABLE NOT TO BE USED FOR DESIGN
EXCEPT WHEN AUTHORIZED IN WRITING

THIS TABLE TO BE USED FOR DESIGN
UNLESS DIRECTED OTHERWISE

State Highway Commission
Helena, Montana

LOADING FOR ROUND R.C.P. CULVERTS

Approved
James G. Butler 12-9-68
State Highway Engineer

SEE STD. DWG. 54-01
FOR BEDDING TYPES
AND CLASSES.

DATA BASED ON AASHTO M. 170
WHICH CONFORMS TO ASTM C 76

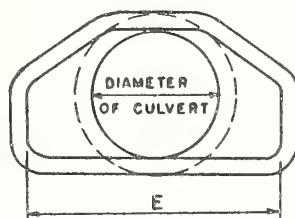
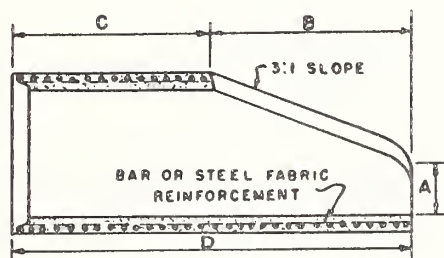
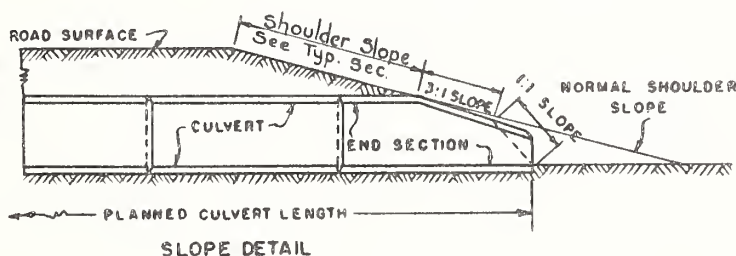
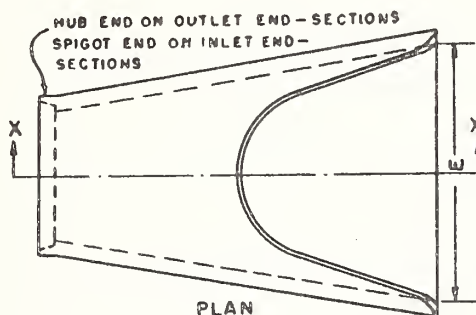
* PROJECTION RATIO -- RATIO OF THE DISTANCE OF THE ORIGINAL
GROUND LINE BELOW THE OUTSIDE TOP OF PIPE TO THE OUTSIDE
DIAMETER OF THE PIPE.

State Highway Commission
Helena, Montana

PREFABRICATED TERMINAL SECTION FOR REINFORCED CONCRETE PIPE

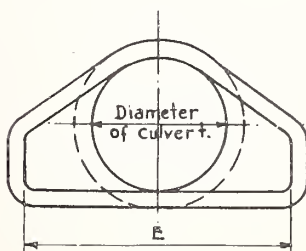
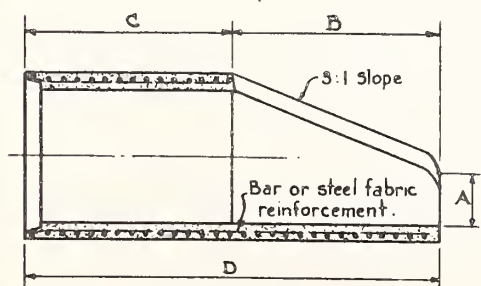
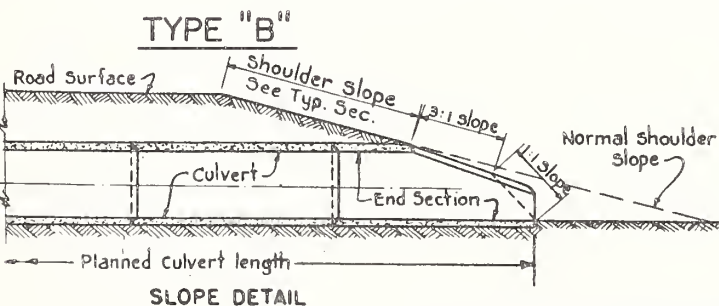
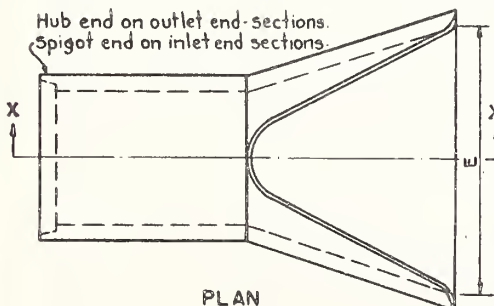
Approved
Levin G. Chittrey 12-9-68
State Highway Engineer

TYPE "A"



TYPE "A"					
TERMINAL SECTION DIMENSION					
DIAM.	A	B	C	D	E
12"	4"	2'-0"	4'-0 3/8"	6'-0 3/8"	2'-0"
15"	6"	2'-3"	3'-10"	6'-1"	2'-6"
18"	9"	2'-3"	3'-10"	6'-1"	3'-0"
24"	9 1/2"	3'-7 1/2"	2'-6"	6'-1 1/2"	4'-0"
30"	1'-0"	4'-6"	1'-7 3/4"	6'-1 3/4"	5'-0"
36"	1'-3"	5'-3"	2'-10 3/4"	8'-1 3/4"	6'-0"
42"	1'-9"	5'-3"	2'-11"	8'-2"	6'-6"
48"	2'-0"	6'-0"	2'-2"	8'-2"	7'-3"
54"	2'-3"	5'-5"	2'-11"	8'-4"	7'-6"

TYPE "B"					
TERMINAL SECTION DIMENSION					
DIAM.	A	B	C	D	E
12"	4"	2'-0"	4'-0 7/8"	6'-0 7/8"	2'-0"
15"	6"	2'-3"	3'-10"	6'-1"	2'-6"
18"	9"	2'-3"	3'-10"	6'-1"	3'-0"
24"	9 1/2"	3'-7 1/2"	2'-6"	6'-1 1/2"	4'-0"
30"	1'-0"	4'-6"	1'-7 3/4"	6'-1 3/4"	5'-0"
36"	1'-3"	5'-3"	2'-10 3/4"	8'-1 3/4"	6'-0"
42"	1'-9"	5'-3"	2'-11"	8'-2"	6'-6"
48"	2'-0"	6'-0"	2'-2"	8'-2"	7'-0"
54"	2'-3"	5'-5"	2'-9 1/4"	8'-2 1/4"	7'-6"



Tolerances, in the above tables, shall not vary more than $\pm 1.5\%$ for the dimensions shown. Otherwise they shall conform to AASHTO M-170

CONSTRUCTION SHALL CONFORM TO CLASS III, AASHTO M 170, AS FAR AS DESIGN WILL PERMIT.

FLARED END TERMINAL SECTION TO BE INCLUDED IN LENGTH OF PIPE SHOWN ON PLANS.

REVISED 1-1-59 11-20-68
EFFECTIVE 1-1-59 1-1-69

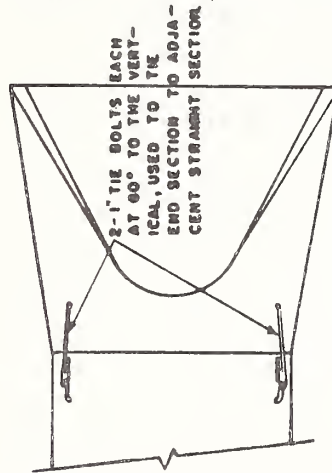
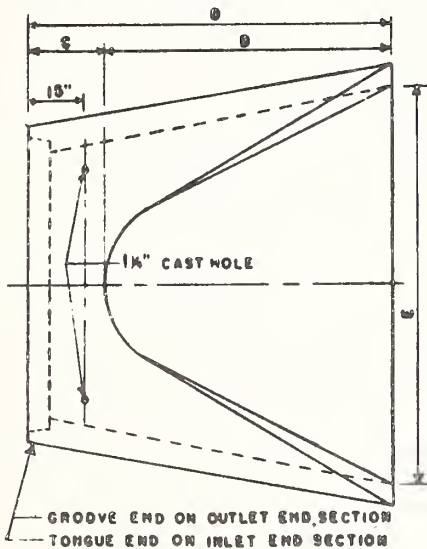
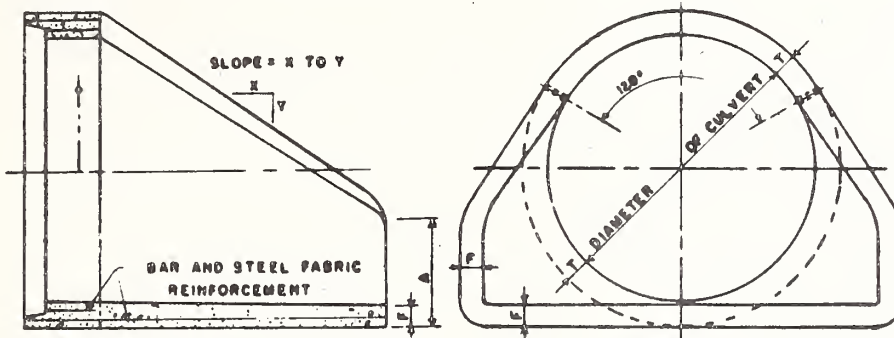
STANDARD DRAWING NO. 62-03

State Highway Commission
Helena, Montana

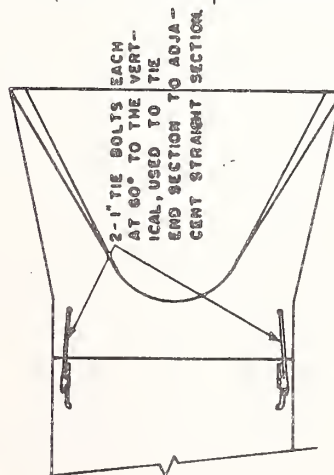
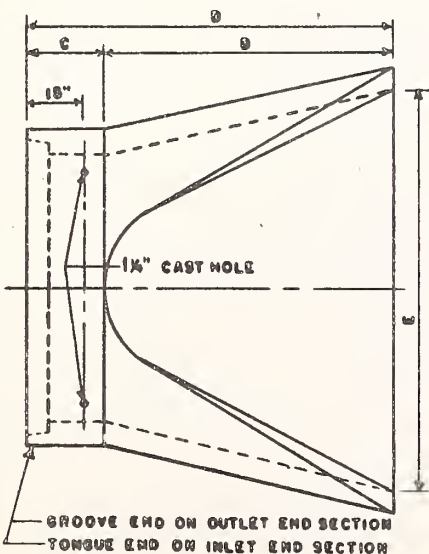
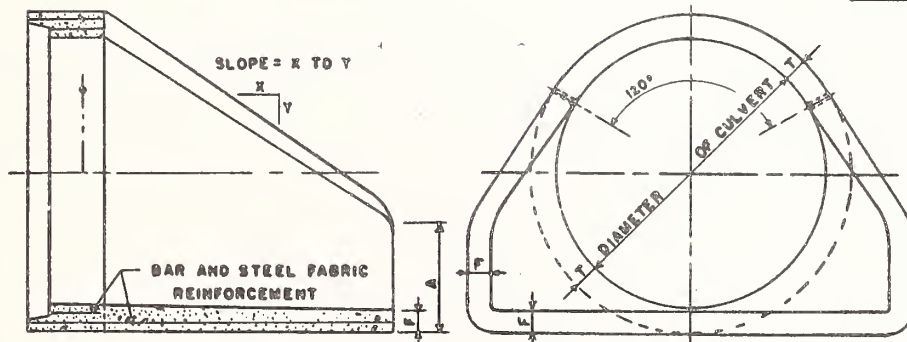
PREFABRICATED TERMINAL SECTION FOR REINFORCED CONCRETE PIPE

Approved

Paul H. Patton 12-9-68
State Highway Engineer



DIAM.	SLOPE	T	A	B	C	D	E	F
60"	2:1	6"	2'11"	5'	3'3"	8'3"	8'	5'
72"	1.86:1	7"	3'	6'6"	1'9"	8'3"	9'	6"
84"	1.5:1	8"	3'	7'6 1/2"	1'9"	9'3 1/2"	10'	6 1/2"



TIE BOLTS. TIE BOLTS TO BE USED ON 72" AND 84" FLARED END SECTIONS. THREE TIE BOLTS, ONE AT TOP AND ONE ON EACH SIDE AT THE HORIZONTAL, SHALL BE USED WHEN REQUIRED. ALL PARTS SHALL BE GALVANIZED.

CONSTRUCTION. CONSTRUCTION SHALL CONFORM TO CLASS III, AASHO M 170, AS FAR AS DESIGN WILL PERMIT.

FLARED END TERMINAL SECTIONS WILL BE INCLUDED IN LENGTH OF PIPE SHOWN ON PLANS.

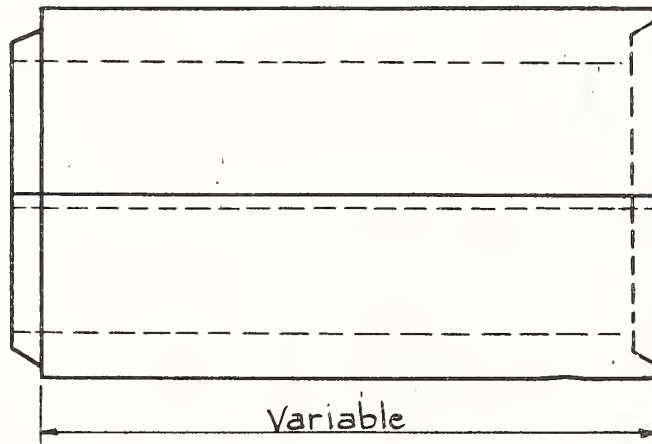
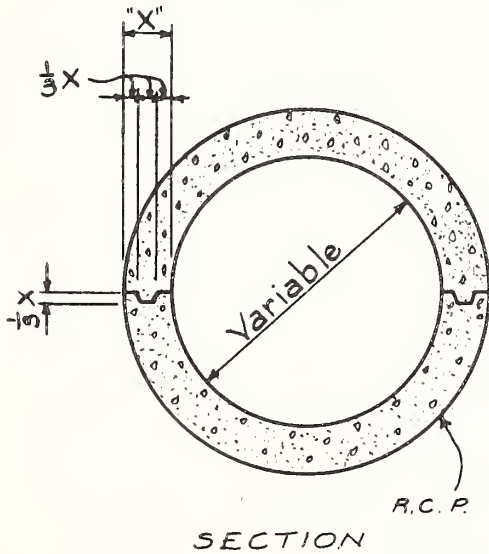
REVISED	9-1-59	11-20-68
EFFECTIVE	9-1-59	1-1-69

STANDARD DRAWING NO. 62 - 04

State Highway Commission
Helena, Montana

PRECAST SPLIT SECTION REINFORCED CONCRETE PIPE

Approved
James A. Sullivan 12-9-68
State Highway Engineer



CONSTRUCTION SHALL
CONFORM TO
AASHO M 170, CLASS
AS SPECIFIED

REVISED 5-1-63 11-20-68
EFFECTIVE 5-1-63 1-1-69

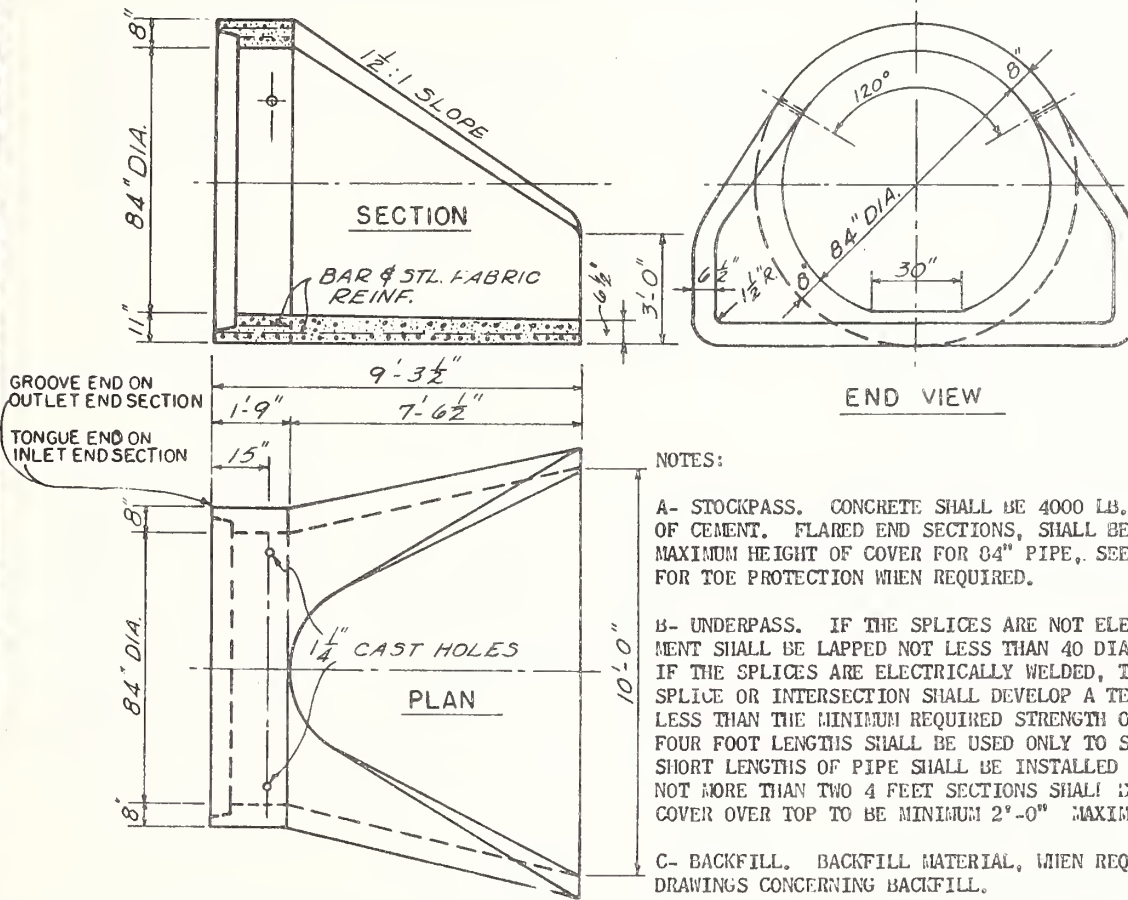
STANDARD DRAWING NO. 63-01

State Highway Commission
Helena, Montana

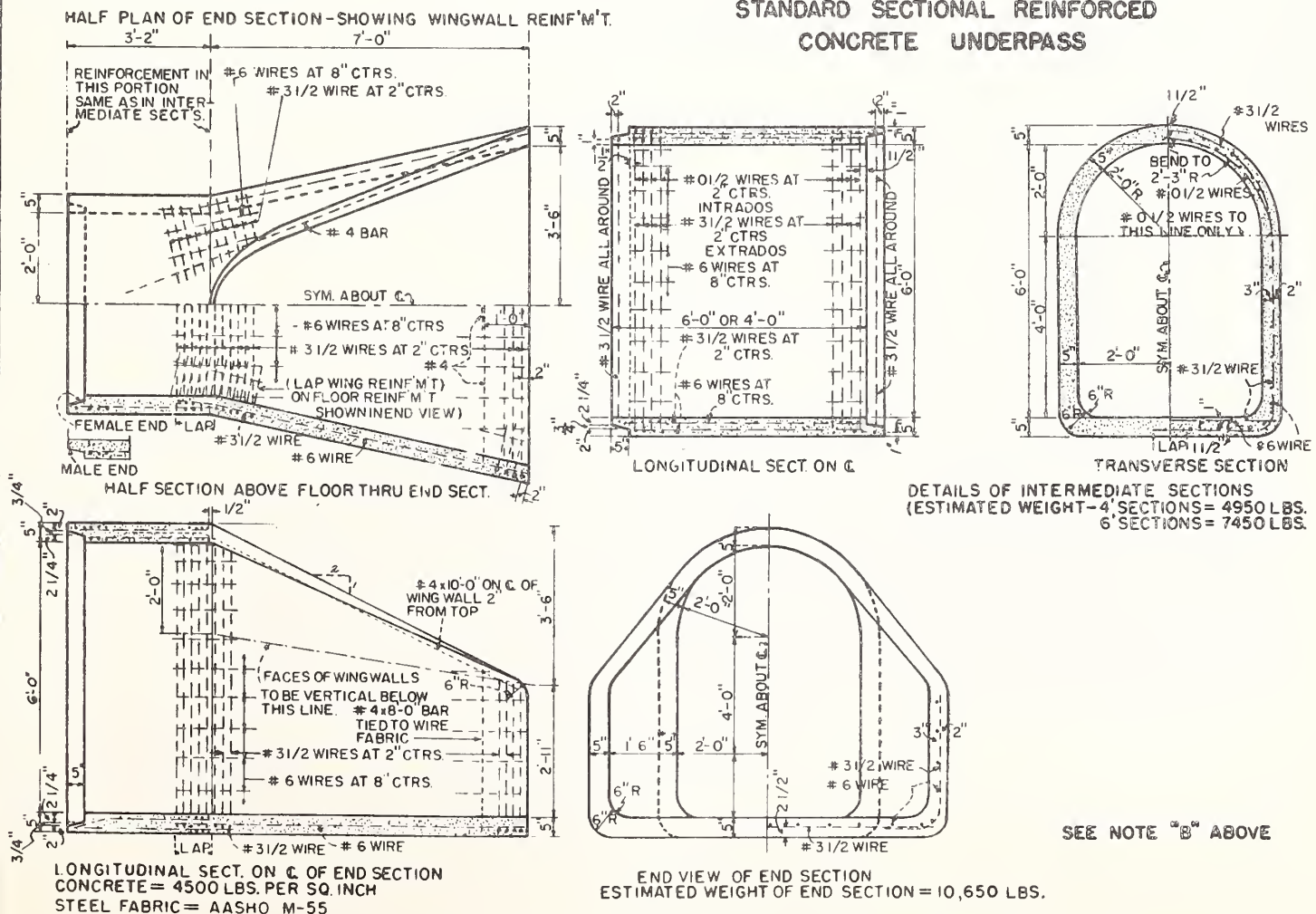
PREFABRICATED CONCRETE UNDERPASS

Approved
James H. Bullington 12-9-68
State Highway Engineer

84" REINFORCE CONCRETE FLAT BOTTOM STOCKPASS



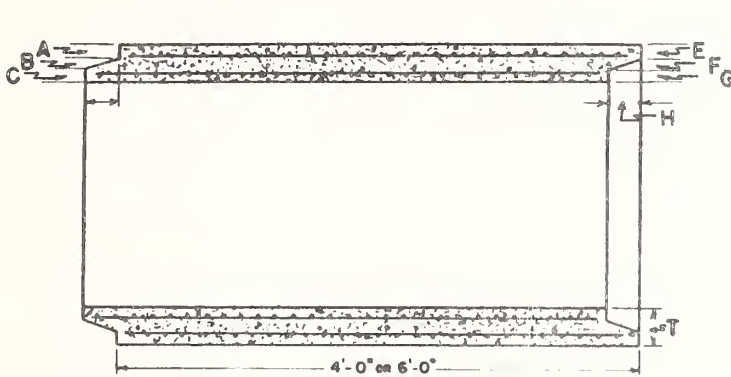
STANDARD SECTIONAL REINFORCED CONCRETE UNDERPASS



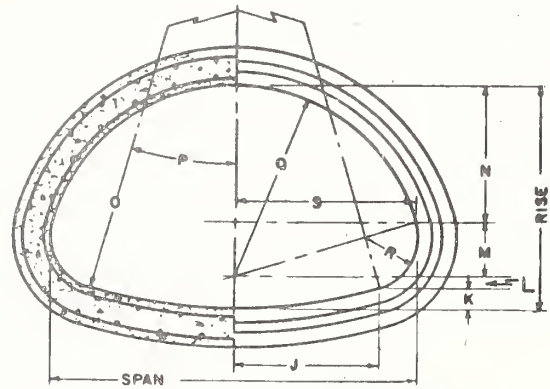
State Highway Commission
Helena, Montana

PREFABRICATED R.C.P. ARCH CULVERT
AND TERMINAL SECTION

Approved
James A. Patton 12-9-68
State Highway Engineer



LONGITUDINAL SECTION



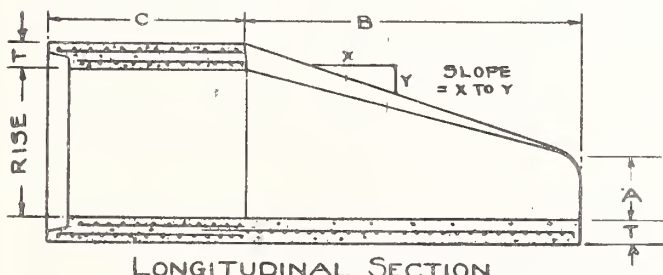
TRANSVERSE SECTION & END VIEW

SIZE	WATER AREA SQ. FT.	SPAN	RISE	As*	T	A	B	C	D	E	F	G	H	J	K	L	M	N	O	P	Q	R	S
18"	1.6	22"	13 1/2"	0.17	2 1/2"	1 5/8"	3/8"	3/4"	2"	1 1/8"	3/8"	1"	2"	7 1/8"	1"		6 1/4"	7 1/2"	27 1/2"	15°	13 3/4"	5 1/2"	3 1/4"
24"	2.8	28 1/2"	18"	0.25	3 1/2"	1 5/8"	1/2"	1 3/8"	3"	1 3/8"	1/2"	1 5/8"	3"	10 1/8"	1 1/8"	1 1/8"	2 1/8"	10 1/8"	40 1/8"	15°30'	(14 3/4")	4 3/8"	14 1/2"
30"	4.4	36 1/4"	22 1/2"	0.22	4"	1 11/16"	5/8"	1 9/16"	3 1/2"	1 9/16"	5/8"	1 11/16"	3 1/2"	13 3/8"	1 11/16"	2"	5 11/16"	12 1/8"	51"	15°30'	18 3/4"	6 1/8"	17 3/4"
36"	6.4	43 3/4"	26 3/8"	0.25	4 1/2"	2"	3/4"	1 3/4"	4"	1 3/4"	3/4"	2"	4"	17 1/8"	2 1/8"	1 3/4"	6 1/4"	16 1/4"	62"	16°	22 1/2"	6 1/2"	21 1/8"
42"	8.8	51 1/8"	31 1/8"	0.30	4 1/2"	2"	3/4"	1 3/4"	4"	1 3/4"	3/4"	2"	4"	20"	2 3/4"	2 1/8"	7 3/8"	19 1/8"	73"	15°15'	26 1/4"	7 1/4"	25 1/4"
48"	11.4	58 1/2"	36"	0.33	5"	2 1/8"	3/4"	2"	5"	2"	3/4"	2 1/4"	5"	22 3/4"	3 1/8"	2 1/8"	8 1/8"	21 1/8"	84"	15°40'	30"	8 1/8"	28 1/8"
54"	14.3	65"	40"	0.37	5 1/2"	2 3/4"	3/4"	2"	5"	2 1/2"	3/4"	2 1/4"	5"	25 1/4"	3 1/2"	3"	9 1/8"	24 3/8"	92 1/2"	15°50'	33 1/2"	10"	32 1/32"
60"	17.7	73 1/2"	45"	0.40	6"	3 1/8"	3/4"	1 11/16"	5"	2 1/4"	3/4"	2 1/8"	5"	28 1/2"	3 11/16"	3 9/16"	10 1/8"	27 1/8"	105"	15°45'	37 1/2"	11 1/8"	36 1/8"
72"	25.6	88"	54"	0.59	7"	3 11/16"	1"	2 3/8"	6"	3 1/4"	1"	2 3/4"	6"	34 1/16"	4 3/4"	4 1/4"	12 1/4"	32 3/4"	126"	15°45'	45"	13 1/8"	43 1/16"

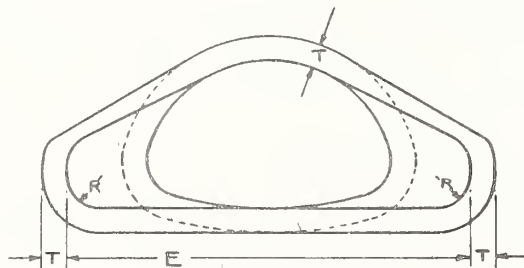
*As--MINIMUM REINFORCEMENT FOR EACH OF THE TWO LINES - STEEL AREA IN SQUARE INCHES PER LINEAL FOOT OF PIPE BARREL. A SINGLE LINE WILL BE USED IN 18" AND 24" SIZES.

CONCRETE STRENGTH IN TERMINAL SECTION SHALL BE EQUAL TO MIN. STRENGTH SPECIFIED FOR BARREL SECTION.

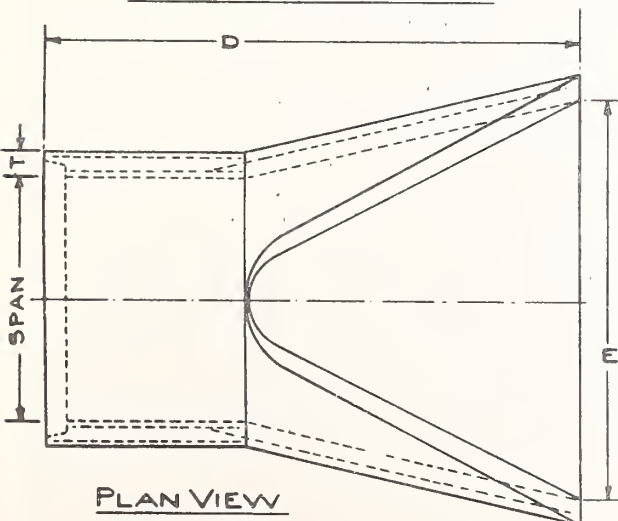
ASTM SPECIFICATIONS C-506 MAY TAKE PRESEDENCE OVER DIMENSIONS SHOWN ABOVE SEE STANDARD SPEC. FOR OTHER REQUIREMENTS.



LONGITUDINAL SECTION



END VIEW



PLAN VIEW

SIZE	SPAN	RISE	T	A	B	C	D	E	R	SLOPE
18"	22"	13 1/2"	2 1/2"	8 1/2"	45"	27"	72"	36"	3"	3 TO 1
24"	28 1/2"	18"	3 1/2"	8 1/2"	39"	33"	72"	48"	3"	3 TO 1
30"	36 1/4"	22 1/2"	4"	9 1/2"	50"	46"	96"	60"	3"	3 TO 1
36"	43 3/4"	26 3/8"	4 1/2"	11 1/8"	60"	36"	96"	72"	6"	3 TO 1
42"	51 1/8"	31 1/8"	4 1/2"	15 1/16"	60"	36"	96"	78"	6"	3 TO 1
48"	58 1/2"	36"	5"	21"	60"	36"	96"	84"	6"	3 TO 1
54"	65"	40"	5 1/2"	25 1/2"	60"	36"	96"	90"	6"	3 TO 1
60"	73 1/2"	45"	6"	31"	60"	36"	96"	96"	6"	3 TO 1
72"	88"	54"	7"	31"	60"	39"	99"	120"	6"	2 TO 1

FLARED END TERMINAL SECTION WILL BE INCLUDED IN LENGTH OF PIPE SHOWN ON PLANS.

State Highway Commission
Helena, Montana

THICKNESS FOR CORRUGATED ALUMINUM PIPE
H-20 LIVE LOAD

Approved

State Highway Engineer

THICKNESS (NOT ELONGATED CORRUGATED ALUMINUM PIPE CULVERTS)														
Area Sq. Ft.	Dia. Inches	Height of Cover Above Top of Culvert (Feet)												
		1-10	11-15	16-20	21-25	26-30	31-35	36-40						
1.2	15	0.060	0.060	0.060	0.060	0.060	0.075	0.105						
1.8	18	0.060	0.060	0.060	0.060	0.075	0.105							
2.4	21	0.060	0.060	0.060	0.075	0.105	0.135							
3.1	24	0.075	0.075	0.075	0.075	0.105	0.135							
4.9	30	0.075	0.075	0.075	0.105	0.135	0.164							
7.1	36	0.105	0.105	0.105	0.135	0.164								
9.6	42	0.105	0.105	0.135	0.164	0.164								

Thickness Inches	Gage (Approx.)
0.060	16
0.075	14
0.105	12
0.135	10
0.164	8

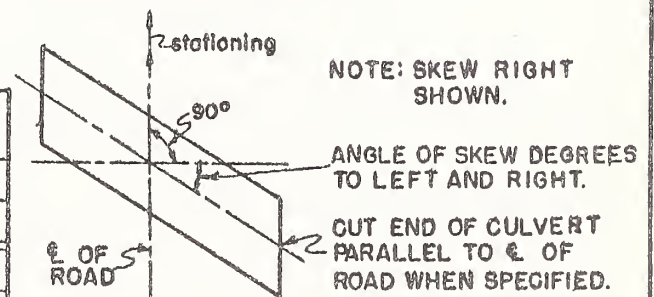
For Lengthening Culverts in Place

USE ELONGATED PIPE

[illegible]

THICKNESS (CORRUGATED ALUMINUM PIPE-ARCH CULVERTS)								
Area Sq. Ft.	Span Inches	Rise Inches			Dia. of Pipe of Eq. Per.	Height of Cover (Feet)		
						2-9	9-12	12-16
1.1	18	11			15	0.060	0.060	0.060
1.6	22	13			18	0.060	0.060	0.060
2.2	25	16			21	0.060	0.060	0.060
2.8	29	18			24	0.075	0.075	0.075
4.4	36	22			30	0.075	0.105	0.105
6.4	43	27			36	0.105	0.105	0.105
8.7	50	31			42	0.105	0.105	0.135
11.4	58	36			48	0.105	0.135	0.135
14.3	65	40			54	0.105	0.135	0.164
17.6	72	44			60	0.135	0.164	—

Note: All dimensions are in inches, except fill height.



NOTE: WHEN SKEW ANGLE EXCEEDS 20° AND THE PIPE ARCH HAS THE ENDS CUT TO FIT A SLOPE, ENDS SHALL BE REINFORCED WITH MASONRY.

REVISED	8-1-63	11-20-68	5-21-69	12-8-69
EFFECTIVE	8-1-63	1-1-69	7-1-69	1-1-70

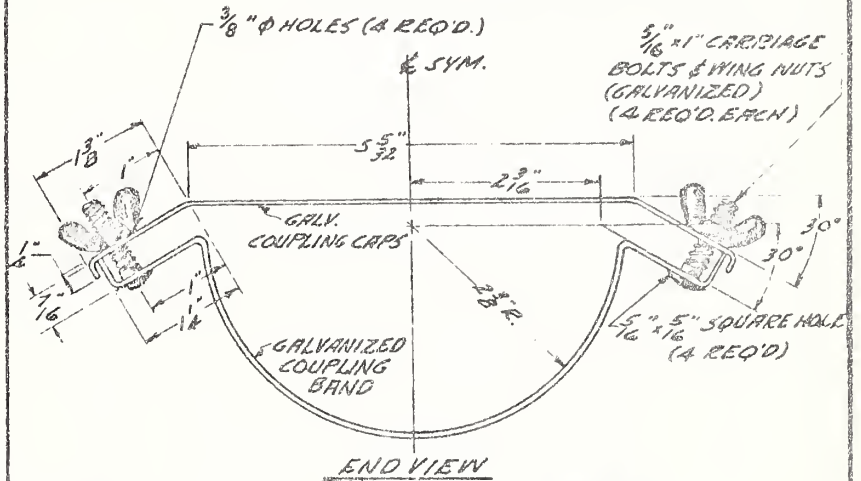
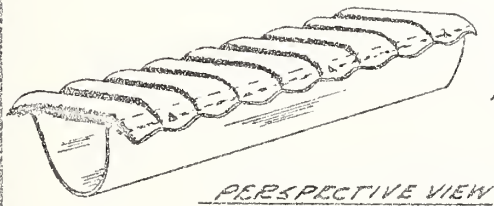
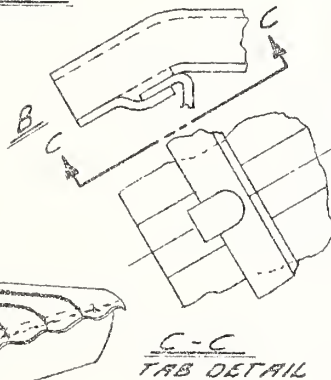
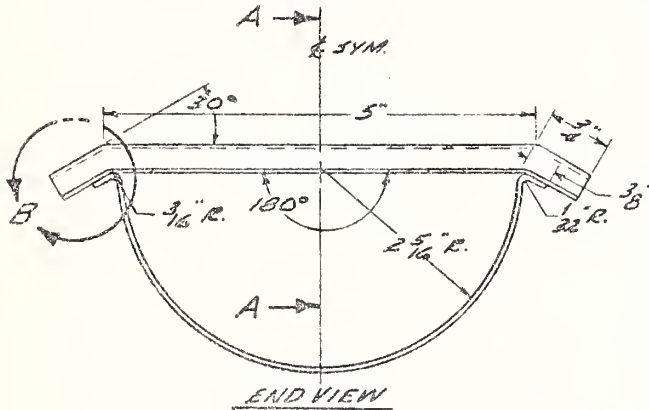
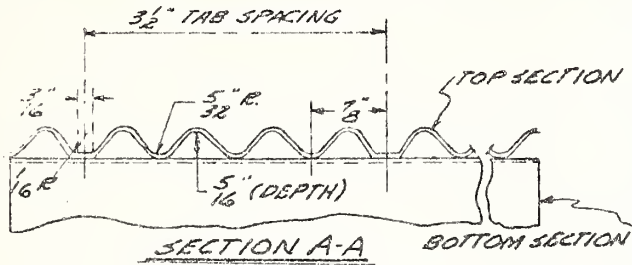
STANDARD DRAWING NO. 69-01

State Highway Commission
Helena, Montana

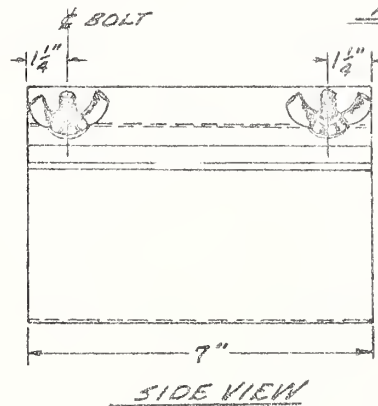
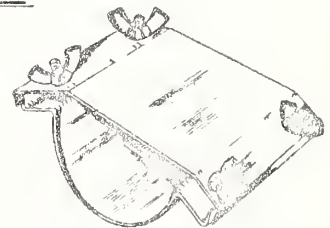
SEMICIRCULAR UNDERDRAIN

Approved

James M. Sullivan 12-9-68
State Highway Engineer



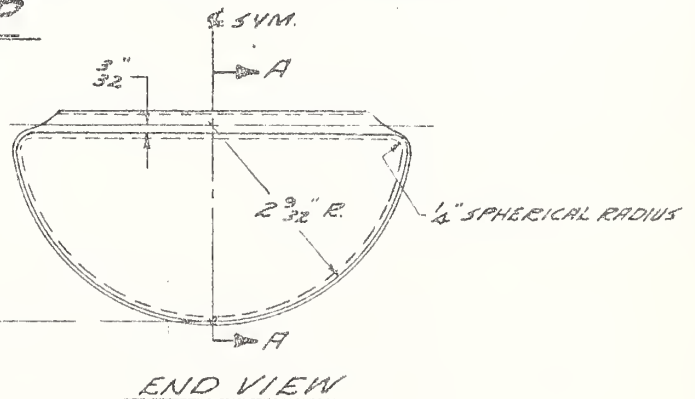
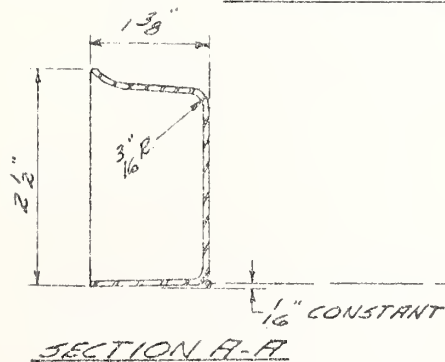
NOTE:
Dimensions may vary
according to the commercial
availability of the product.



NOTES: ALL MAT'L
SHALL BE 0.052".
SUBDRAIN PIPE
SECTIONS SHALL
CONFORM TO A.S.H.O.
M-136-65
GALVANIZING OF
NUTS, BOLTS, END
SCREEN, END CAP
AND OTHER LIKE
PARTS SHALL CON-
FORM TO A.S.T.M.
A 153

COUPLING BAND DETAILS

END CAP



NOTES:
MATERIAL TO BE 18 GAGE COPPER
BEARING GALVANIZED STEEL.
END OF CAP TO FIT SNUG, WHEN
INSERTED INSIDE END OF UNDERDRAIN.
TOLERANCES ARE ± 1/16" EXCEPT AS
SHOWN.
2" GALV. MESH SCREEN, SHAPED
LIKE THE CAP, TO BE PROVIDED FOR
EACH PIPE OUTLET.

REVISED	9-1-62	11-20-68
EFFECTIVE	9-1-62	1-1-69

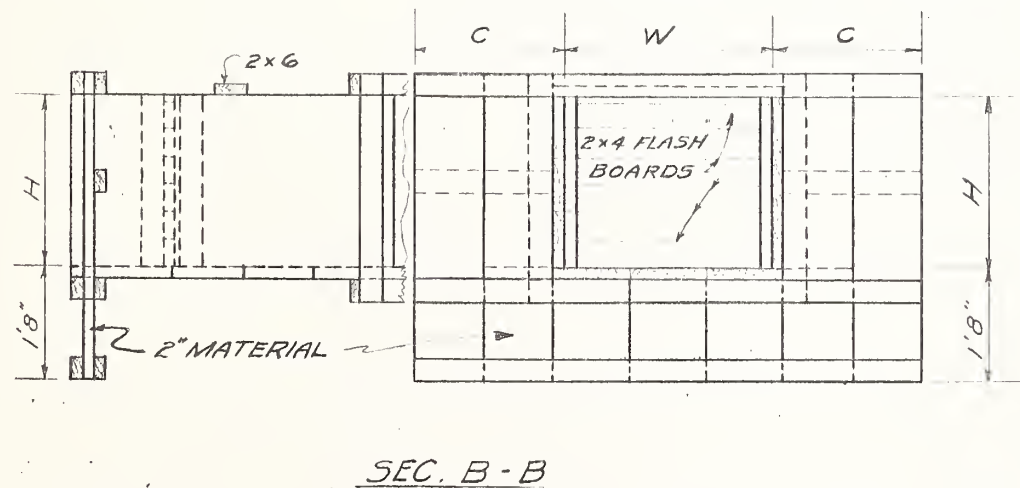
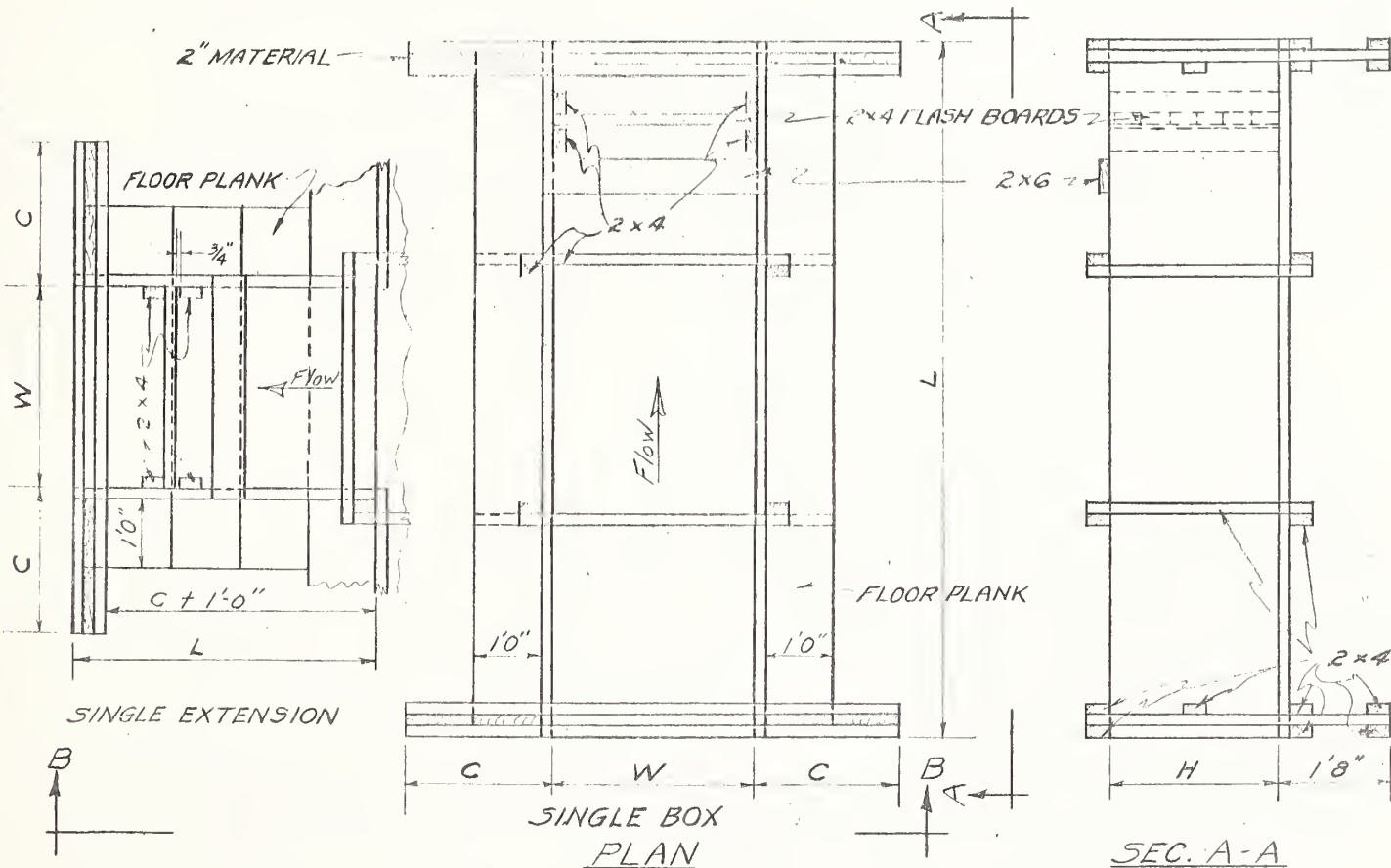
STANDARD DRAWING NO. 73-01

State Highway Commission
Helena, Montana

WOODEN DIVISION BOX

Approved

Livingston
State Highway Engineer



NOTES:- SIDES AND FLOOR TO BE OF S4S 2" MATCHED MATERIAL.
NAILS TO BE INCLUDED IN UNIT PRICE BID FOR LUMBER.
ALL NAILS TO BE GALVANIZED.
WHEN THE PLANS PROVIDE FOR TREATED LUMBER, TREATMENT SHALL BE DONE BY IMMERSING THE LUMBER IN A SOLUTION CONTAINING 5% PENTACHLOROPHENOL. TREATMENT MUST BE DONE IN SUCH A MANNER AND WITH SUCH A CARRYING AGENT THAT THE PENTA WILL PENETRATE THE WOOD AT LEAST ONE-FOURTH INCH.

DIMENSIONS & MBM LUMBER										
SINGLE BOX						SINGLE EXTENSION				
	W	H	C	L	MBM LMBR.	W	H	C	L	MBM LMBR.
18"	1'6"	1'6"	2'3"	9'0"	.268	1'6"	1'6"	2'3"	3'9"	.112
24"	2'0"	2'0"	3'0"	11'0"	.390	2'0"	2'0"	3'0"	4'6"	.165
30"	2'6"	2'6"	3'9"	13'0"	.530	2'6"	2'6"	3'9"	5'3"	.223
36"	3'0"	3'0"	4'6"	15'0"	.690	3'0"	3'0"	4'6"	6'0"	.291

- 1-WAY - SINGLE BOX
- 2-WAY - SINGLE BOX + ONE EXTENSION
- 3-WAY - SINGLE BOX + TWO EXTENSIONS

SEE STANDARD SPEC. THE TERM "DIVISION BOX" REPLACES "HEADGATE" CONTAINED THEREIN.

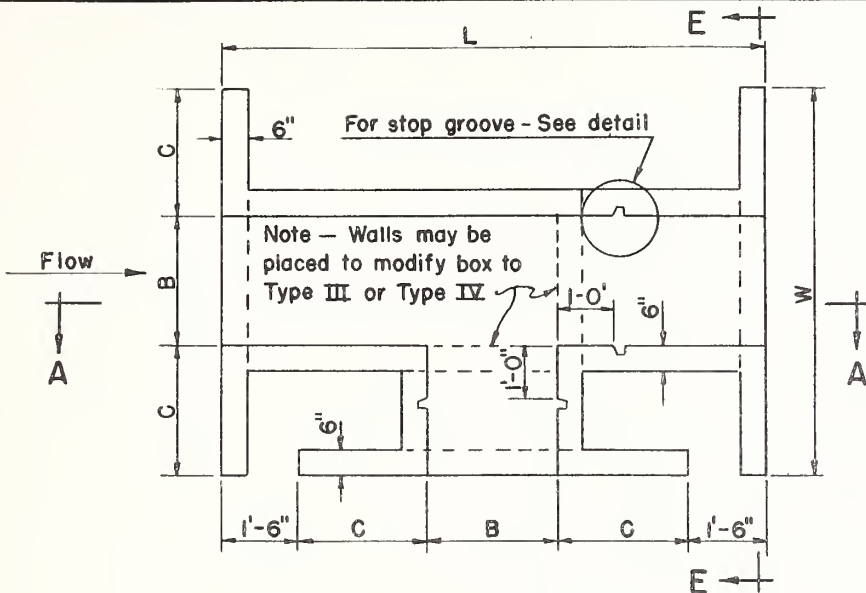
REVISED 1-1-64 11-20-68
EFFECTIVE 1-1-64 1-1-69

STANDARD DRAWING NO. 73- 02

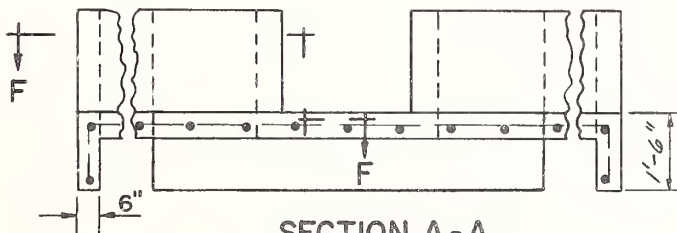
State Highway Commission
Helena, Montana

CONCRETE DIVISION BOX

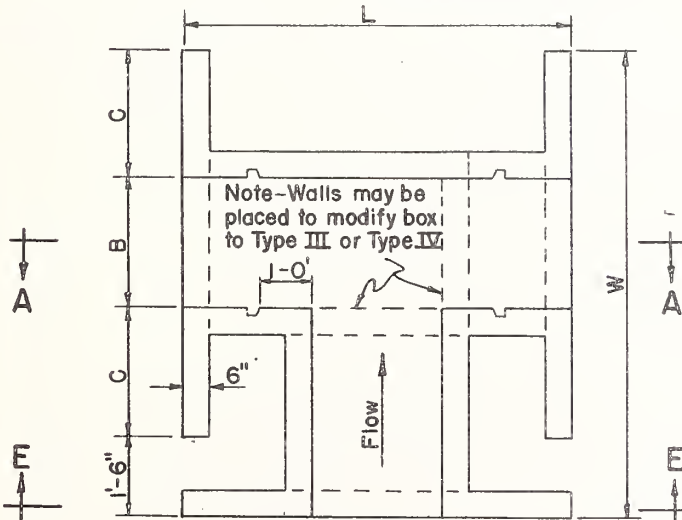
Approved
State Highway Engineer



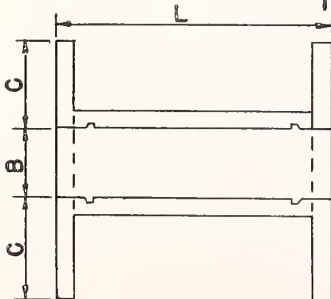
PLAN
TYPE I



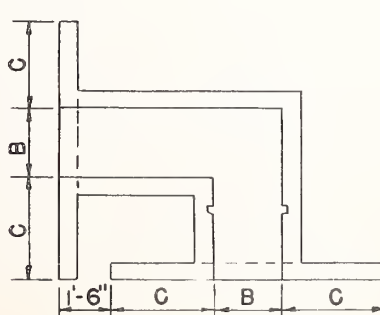
SECTION A-A



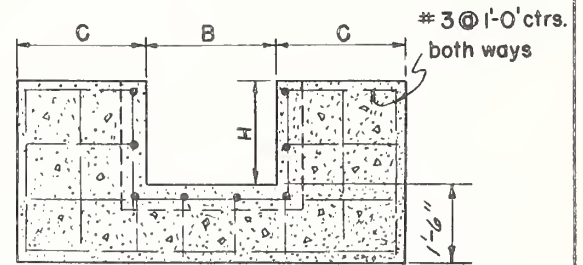
PLAN
TYPE II



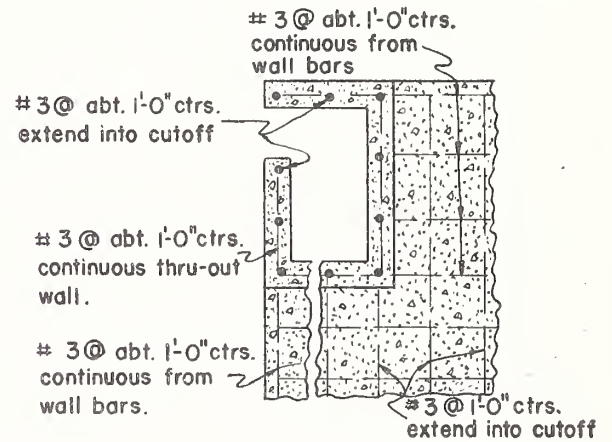
TYPE III



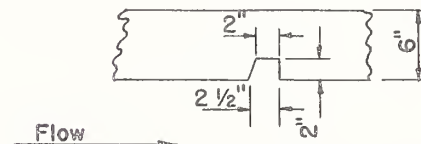
TYPE IV



SECTION E-E



SECTION F-F



STOP GROOVE DETAIL

	DIMENSIONS & QUANTITIES						Lbs. Reinf. Steel
	B	C	H	L	W	"DD" CONC. OR EQUAL	
TYPE I	2'-0"	3'-0"	2'-0"	11'-0"	8'-0"	2.8	134
	2'-6"	3'-6"	2'-0"	12'-6"	9'-6"	3.4	145
	3'-0"	4'-0"	2'-6"	14'-0"	11'-0"	4.6	208
TYPE II	2'-0"	3'-0"	2'-0"	8'-0"	9'-6"	2.6	126
	2'-6"	3'-6"	2'-0"	9'-6"	11'-0"	3.1	145
	3'-0"	4'-0"	2'-6"	11'-0"	12'-6"	4.3	194

Note - Division Box may be modified if desired with dimensions shown on the plans. Reinforcing steel & Excavation shall be included in unit price bid for concrete; also the required flashboards.

STANDARD DRAWING NO. 73-03

Approved
Samuel H. Galt 12-9-68
 State Highway Engineer



USE 24" PIPE

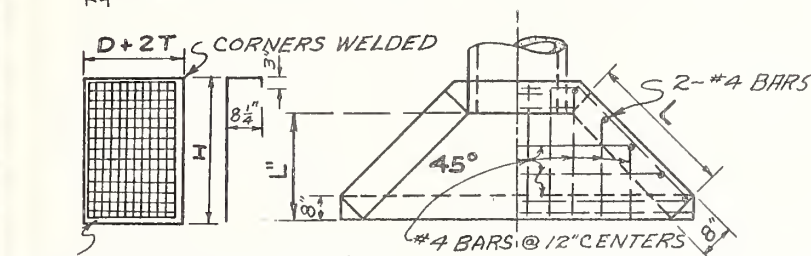
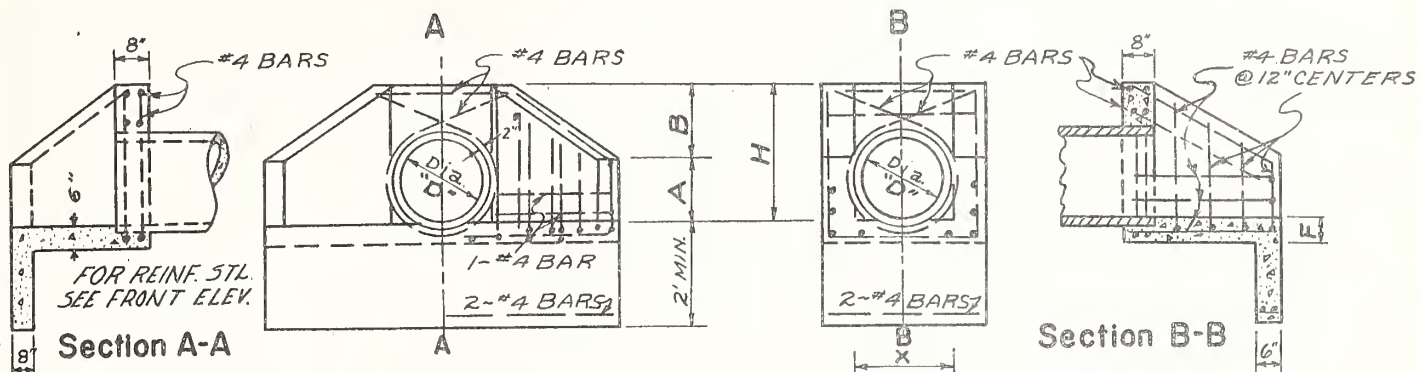
REVISED 5-1-63 11-20-68
EFFECTIVE 5-1-63 1-1-69

STANDARD DRAWING NO. 73-04

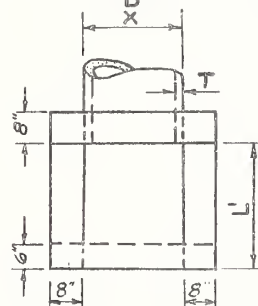
State Highway Commission
Helena, Montana

INLET & OUTLET HEADWALLS FOR R.C.P. & C.M.P. PIPES

Approved
James J. Chaffin 12-9-68
State Highway Engineer



1' x 1/4" STRAP IRON FRAME
3/4" MESH GALVANIZED SCREEN
SOLDERED TO IRON FRAME.
INLET SCREEN (NOT TO BE
USED UNLESS RECOMMENDED
BY ENGINEER) SCREEN TO
BE ABSORBED IN UNIT PRICE
BID FOR LINEAL FEET OF PIPE.



ALL EXPOSED CORNERS
TO BE CHAMFERED 1".
REINFORCING STEEL TO
BE NOT LESS THAN 1 1/2"
TO NEAREST FACE OF
CONCRETE.

D = INSIDE DIAMETER
T = THICKNESS OF SHELL.

INLET HEADWALL

OUTLET HEADWALL

INLET & OUTLET HEADWALLS FOR R.C.P.												
CULVERT		CL. "DD" CONC. OR EQUAL (Cu Yds)		REINF. STEEL LBS.		DIMENSION TABLE						
DIA. "D"	AREA SQ. FT.	IN- LET	OUT- LET	IN- LET	OUT- LET	L	L'	A	B	X	F	L"
18"	1.77	.80	.60	65	53	2'-6"	2'-2"	1'-3"	1'-3"	1'-11"	6.5"	1'-9"
24"	3.14	1.00	.86	85	69	3'-0"	2'-6"	1'-6"	1'-6"	2'-6"	7"	2'-1"
30"	4.91	1.42	1.14	104	85	3'-6"	2'-10"	1'-9"	1'-9"	3'-1"	7.5"	2'-6"
36"	7.07	1.84	1.43	126	101	4'-0"	3'-2"	2'-0"	2'-0"	3'-8"	8"	2'-10"
42"	9.62	2.12	1.73	150	117	4'-6"	3'-6"	2'-3"	2'-3"	4'-3"	8.5"	3'-2"
48"	12.57	2.34	2.07	175	134	5'-0"	3'-10"	2'-6"	2'-6"	4'-10"	9"	3'-6"

INLET & OUTLET HEADWALLS FOR C.M.P.												
CULVERT		CL. "DD" CONC. OR EQUAL (Cu Yds)		REINF. STEEL LBS.		DIMENSION TABLE						
DIA. "D"	AREA SQ. FT.	IN- LET	OUT- LET	IN- LET	OUT- LET	L	L'	A	B	H	L"	
18"	1.77		.73	.59	62	50	2'-6"	2'-2"	1'-3"	1'-3"	2'-6"	1'-9"
24"	3.14		.91	.76	82	54	3'-0"	2'-6"	1'-6"	1'-6"	3'-0"	2'-1"
30"	4.91		1.06	.95	99	66	3'-6"	2'-10"	1'-9"	1'-9"	3'-6"	2'-6"
36"	7.07		1.68	1.11	116	82	4'-0"	3'-2"	2'-0"	2'-0"	4'-0"	2'-10"
42"	9.62		2.10	1.40	139	105	4'-6"	3'-6"	2'-3"	2'-3"	4'-6"	3'-2"
48"	12.57		2.32	1.66	162	124	5'-0"	3'-10"	2'-6"	2'-6"	5'-0"	3'-6"

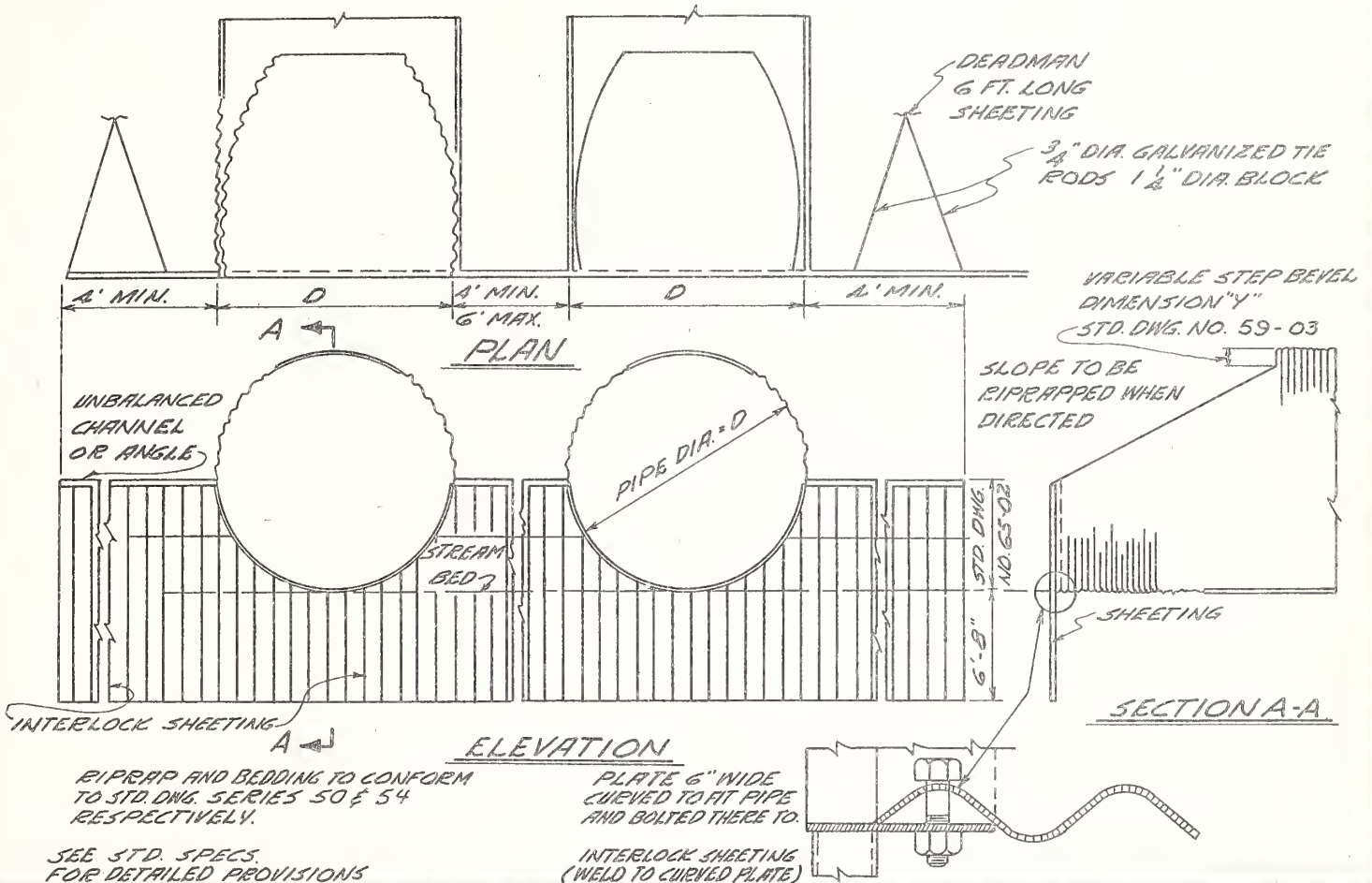
REINFORCING STEEL AS INDICATED TO BE
INCLUDED IN THE UNIT PRICE BID PER CUBIC
YARD OF CONCRETE.

State Highway Commission
Helena, Montana

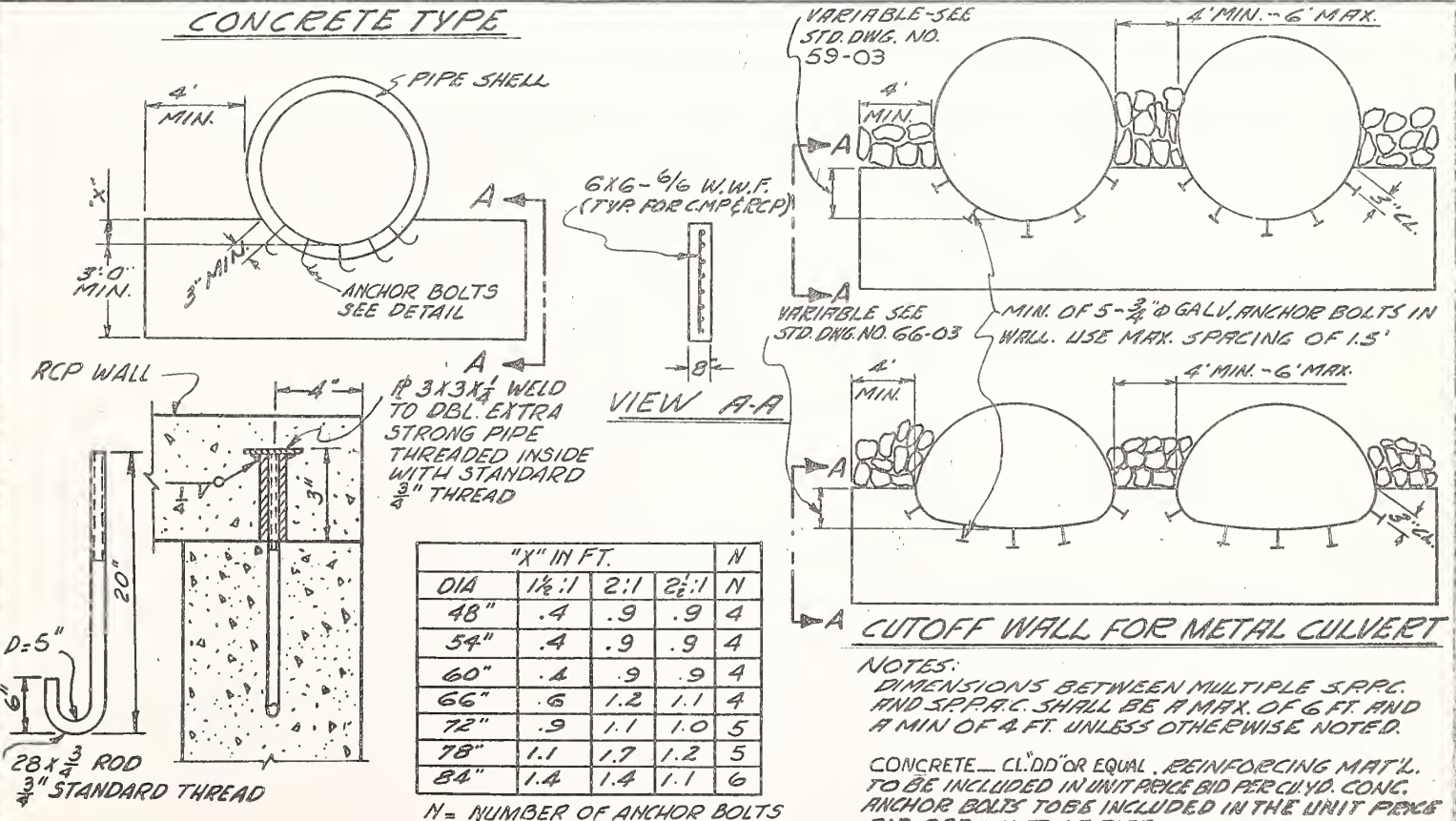
CUTOFF WALLS FOR CULVERTS

Approved
J. M. Smith 12-7-68
State Highway Engineer

METAL TYPE



CONCRETE TYPE



NOTE:
GREASE THREAD TO KEEP MOISTURE OUT

State Highway Commission

Helena, Montana

CUTOFF WALL QUANTITIES

Approved

State Highway Engineer

REINFORCED CONCRETE PIPE

DIAMETER OF PIPE (IN.)	CU. YDS. CONCRETE REQ'D. FOR 8" THICKNESS		
	1½:1 BEV.	2:1 BEV.	2½:1 BEV.
60	1.1	1.2	1.2
66	1.2	1.3	1.3
72	1.3	1.4	1.3
78	1.4	1.5	1.4
84	1.5	1.5	1.4

NOTES:

THESE THREE TABLES HAVE BEEN
TABULATED FOR SINGLE PIPE AT ONE
END ONLY.

CONCRETE SHALL BE CLASS "DD"
OR EQUAL.

CIRCULAR CSP & SSPPC

DIAMETER OF PIPE (IN.)	CU. YDS. CONC. REQ'D. FOR 8" THICKNESS	DIAMETER OF PIPE (IN.)	CU. YDS. CONC. REQ'D. FOR 8" THICKNESS
60	1.3	162	2.7
66	1.4	168	2.8
72	1.4	174	2.9
78	1.5	180	3.0
84	1.6	192	3.2
90	1.7	198	3.3
96	1.7	204	3.4
102	1.8	210	3.5
108	1.9	216	3.6
114	2.0	228	3.8
120	2.1	240	4.0
126	2.2	252	4.3
132	2.3		
138	2.3		
144	2.4		
150	2.5		
156	2.6		

FORMULAS

V_s = QUANTITY FOR SINGLE PIPE - CUTOFF
WALL AT ONE END ONLY (CU. FT.)

V_d = QUANTITY FOR DOUBLE PIPE - CUTOFF
WALL AT ONE END ONLY (CU. FT.)

L = LENGTH OF SINGLE PIPE - CUTOFF WALL

H = HEIGHT OF SINGLE PIPE - CUTOFF
WALL. $(3.0 + X)$

T = THICKNESS = 0.67'

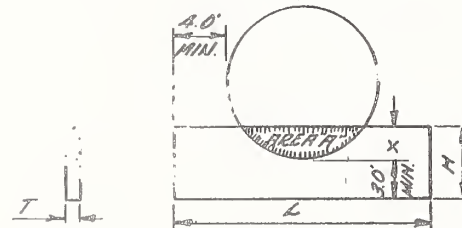
A = AREA "A" - SEE STD. DWGS. 59-05; 59-03

$V_s = T(LH - A)$

$V_d = 2T[LH(L-2) - A]$

$V_s/2.7$ = QUANTITY IN CU. YDS.

$V_d/2.7$ = QUANTITY IN CU. YDS.



STRUCTURAL PLATE PIPE ARCH

SPAN	RISE	EQUIV. DIAMETER OF PIPE (IN.)	CU. YDS. CONCRETE REQ'D. FOR 8" THICKNESS		
			1½:1 BEV.	2:1 BEV.	2½:1 BEV.
6'-1"	4'-7"	66	1.6	1.6	1.6
6'-3"	4'-11"	72	1.6	1.6	1.6
7'-3"	5'-3"	78	1.6	1.6	1.6
7'-11"	5'-7"	84	1.7	1.7	1.7
8'-7"	5'-11"	90	1.8	1.8	1.8
9'-4"	6'-3"	96	1.9	1.9	1.9
9'-9"	6'-7"	102	1.8	1.8	1.8
10'-8"	6'-11"	108	2.1	2.1	2.1
11'-5"	7'-3"	114	2.1	2.1	2.1
11'-10"	7'-7"	120	2.1	2.1	2.1
12'-6"	7'-11"	126	2.2	2.2	2.2
12'-10"	8'-4"	132	2.1	2.1	2.1
14'-0"	9'-8"	144	2.5	2.5	2.5
15'-4"	10'-4"	156	2.7	2.7	2.7
16'-6"	11'-0"	168	2.7	2.7	2.7
17'-11"	11'-8"	180	2.9	2.9	2.9
19'-3"	12'-4"	192	3.1	3.1	3.1
20'-5"	13'-0"	204	3.2	3.2	3.2

NOTES:

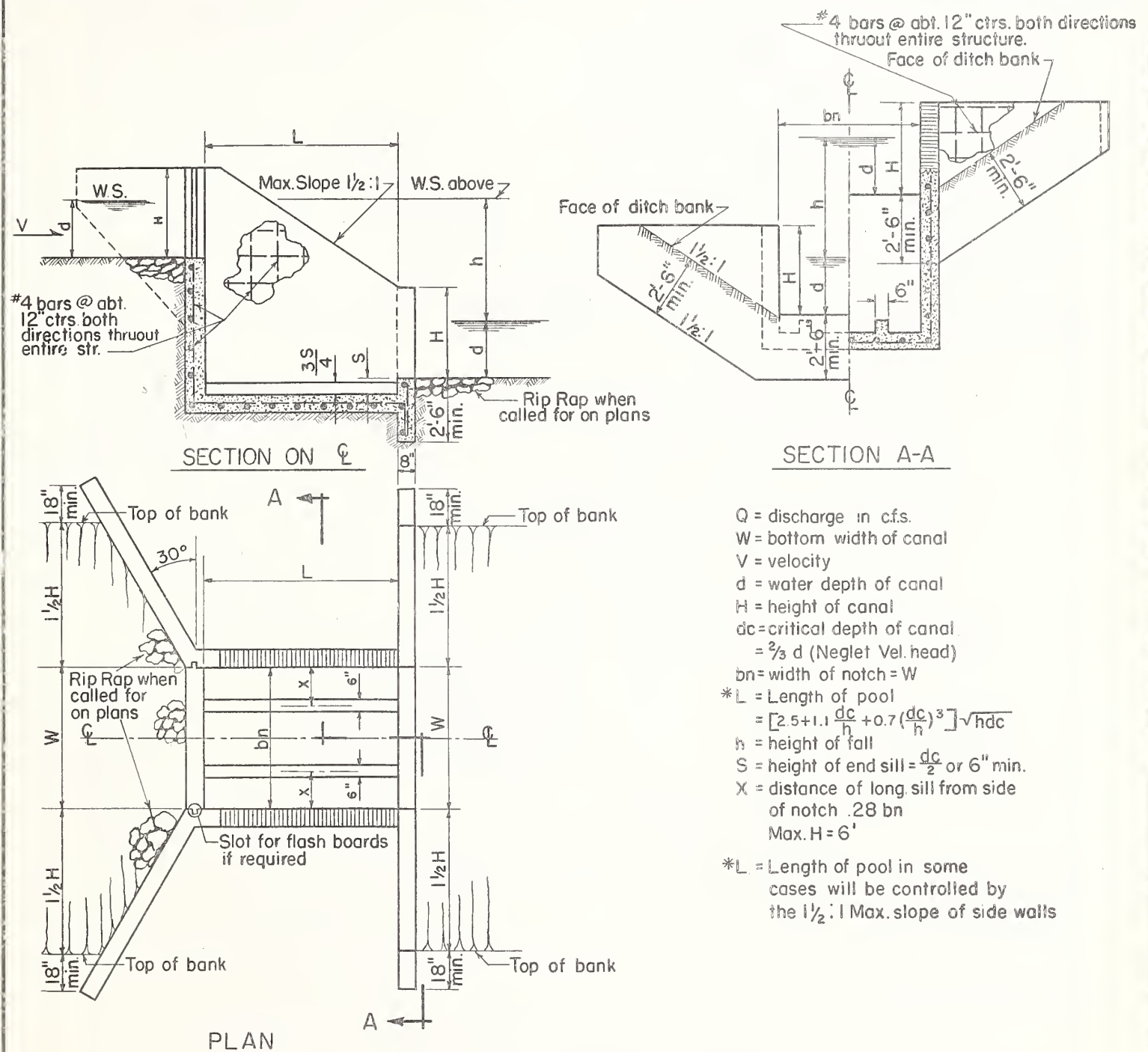
18" CORNER PLATES -- 6'-1" x 4'-7"
SIZE THROUGH 12'-10" x 8'-4" SIZE.

31" CORNER PLATES -- 14'-0" x 9'-8"
SIZE THROUGH 20'-5" x 13'-0" SIZE.

State Highway Commission
Helena, Montana

STANDARD DITCH DROP

Approved
James H. Helton 12-7-68
State Highway Engineer



DIMENSIONS & QUANTITIES								3' & 5' DROPS W.S. TO W.S.	
W	d	H	*L	h	bn	X	S	REINF. STEEL IN LBS.	CL. DD' CONC. or EQUAL
2.0'	1.0'	2.0'	4.5'	3.0'	2.0'	0.56'	0.5'	#4-235	3.5
2.0'	1.5'	2.5'	5.0'	3.0'	2.0'	0.56'	0.5'	#4-266	3.9
3.0'	1.5'	2.5'	5.0'	3.0'	3.0'	0.84'	0.5'	#4-282	4.2
3.0'	2.0'	3.5'	6.0'	3.0'	3.0'	0.84'	0.67'	#4-381	6.3
4.0'	2.0'	3.5'	6.0'	3.0'	4.0'	1.12'	0.67'	#4-398	6.6
4.0'	2.5'	4.0'	7.0'	3.0'	4.0'	1.12'	0.83'	#4-466	7.9
2.0'	1.0'	2.0'	7.5'	5.0'	2.0'	0.56'	0.5'	#4-314	5.0
2.0'	1.5'	2.5'	7.5'	5.0'	2.0'	0.56'	0.5'	#4-344	5.6
3.0'	1.5'	2.5'	7.5'	5.0'	3.0'	0.84'	0.5'	#4-367	6.0
3.0'	2.0'	3.5'	7.5'	5.0'	3.0'	0.84'	0.67'	#4-442	7.5
4.0'	2.0'	3.5'	7.5'	5.0'	4.0'	1.12'	0.67'	#4-464	7.9
4.0'	2.5'	4.0'	8.5'	5.0'	4.0'	1.12'	0.83'	#4-540	9.3

Flash boards, when required, to be included in price bid for structure.

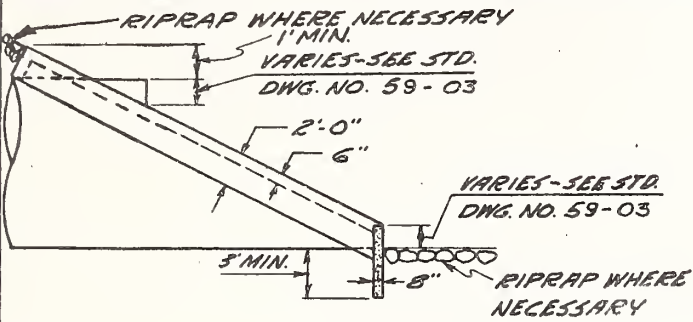
REVISED	3-1-66	11-20-68
EFFECTIVE	3-1-66	1-1-69

STANDARD DRAWING NO. 73-08

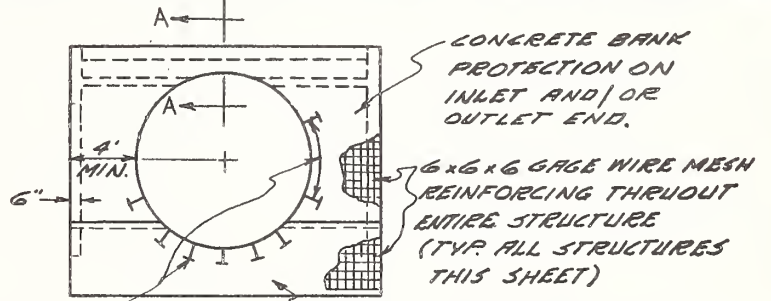
State Highway Commission
Helena, Montana

CONCRETE EDGE PROTECTION FOR STRUCTURAL PLATE PIPE
CULVERT & FOR STRUCTURAL PLATE PIPE ARCH CULVERT *

Approved
State Highway Engineer



SIDE ELEV.

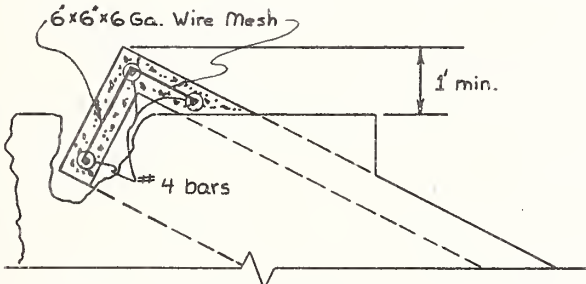


FRONT ELEV.

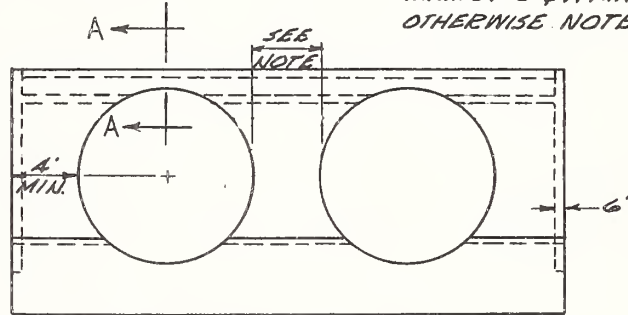
3/4" Ø ANCHOR BOLTS @ ABT. 18" CENTERS AROUND ENTIRE PERIPHERY OF PIPE EMBEDDED IN CONCRETE. (TYP. ALL STRUCTURES THIS SHEET)

CUT OFF WALL INLET & OUTLET END. SEE STD. DWG. NO. 73-05

NOTE: DIMENSIONS BETWEEN MULTIPLE PIPES SHALL BE A MAX. OF 6' & A MIN. OF 4' UNLESS OTHERWISE NOTED.

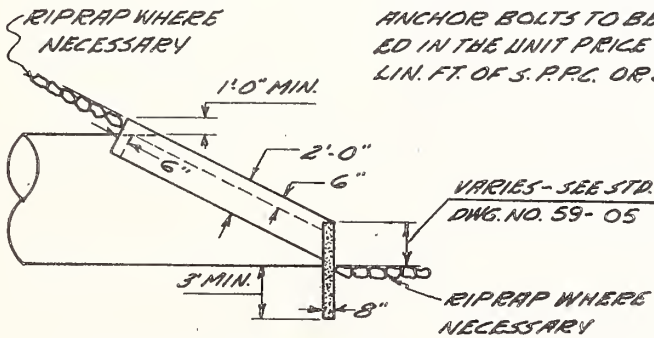


SECTION A-A

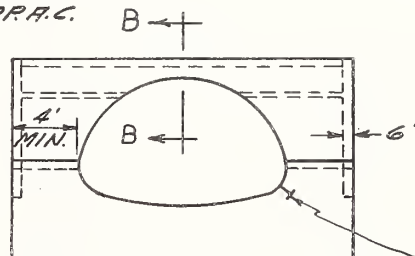


FRONT ELEVATION MULTIPLE PIPES

CL. "DD" CONCRETE OR EQUAL, REINFORCING MATL. TO BE INCLUDED IN THE UNIT PRICE BID PER CU. YDS. OF CONCRETE. ANCHOR BOLTS TO BE INCLUDED IN THE UNIT PRICE BID PER LIN. FT. OF S.P.P.C. OR S.P.P.A.C.



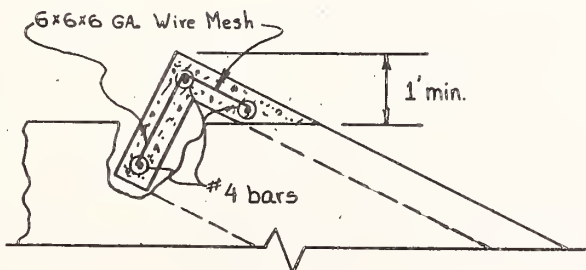
SIDE ELEVATION



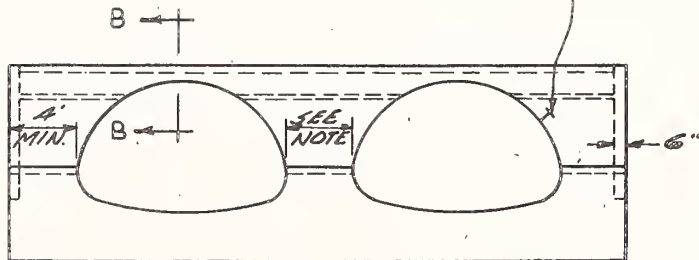
FRONT ELEVATION

FOR BACKFILL MATERIAL AND PLACEMENT SEE STD. DWG. NO. 54-03

FOR ANCHOR BOLT SPACING SEE NOTE ABOVE



SECTION BB



FRONT ELEVATION MULTIPLE PIPES

* THIS CONCRETE COLLAR IS TO HELP PREVENT METAL FAILURE OF CULVERT EDGE ESPECIALLY WHERE HIGH HEADWATERS ARE PREVALENT.

RECEIVED 11/10/73
FBI - NEW YORK

TO DIRECTOR, FBI (100-441134)



1. [illegible]
2. [illegible]
3. [illegible]
4. [illegible]
5. [illegible]
6. [illegible]
7. [illegible]
8. [illegible]
9. [illegible]
10. [illegible]

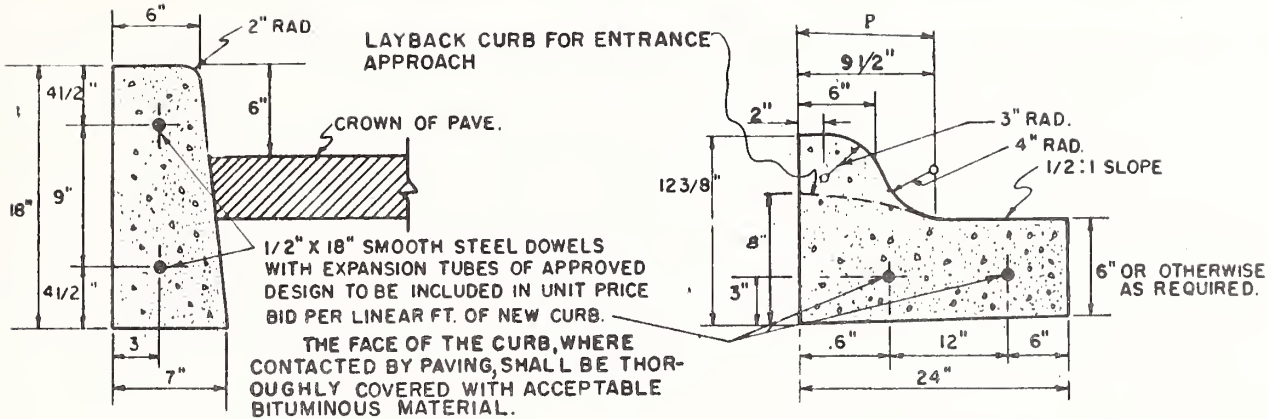
State Highway Commission
Helena, Montana

STANDARD CURBS

Approved

John H. Rittinger 11-2-68
State Highway Engineer

CONCRETE CURBS



CURB
#0.031 C.Y. CONC PER 1.0'

CURB & GUTTER
#0.048 C.Y. CONC PER 1.0'
FOR 6" GUTTER

P- WHEN PAINTED CURB IS REQUIRED, THIS IS THE AREA TO BE COVERED. PAINTING INCLUDED IN COST OF CURB.

JOINTS:

(A) WHEN DEFINITELY TIED TO PAVEMENT SLAB. SEPARATE CURB OR INTEGRAL CURB AND GUTTER SHALL HAVE THE EXPANSION JOINT OF THE PAVEMENT SLAB EXTENDED THROUGH AND SHALL BE COMPLETELY FILLED WITH A MINIMUM OF 1/2" WIDTH OF PREFORMED EXPANSION JOINT FILLER WITH DOWEL BARS FITTED WITH EXPANSION TUBES AT EACH JOINT.

(B) WHEN NOT DEFINITELY TIED TO PAVEMENT SLAB. SEPARATE CURB OR INTEGRAL CURB AND GUTTER SHALL HAVE THROUGH JOINTS AT PREDETERMINED INTERVALS FILLED WITH A MINIMUM OF 1/2" WIDTH OF PREFORMED EXPANSION JOINT FILLER AND WITH DOWEL BARS FITTED WITH EXPANSION TUBES. SUCH JOINT INTERVALS SHALL BE DETERMINED BY PRORATING THE DISTANCE BETWEEN CURB RETURNS WITH SUCH INTERVALS TO BE NOT LESS THAN 30 FEET NOR GREATER THAN 50 FEET. DOWEL BARS WITH EXPANSION TUBES AND A MINIMUM OF 1/2" WIDTH OF PREFORMED EXPANSION JOINT FILLER SHALL BE PLACED AT THE TERMINI OF ALL CURB RETURNS EXCEPT THAT ONLY DOWEL EXPANSION TUBES SHALL BE PLACED IN THE END OF THE CURB RETURN WHEN THE CURB RETURN IS NOT ABUTTING OLD CURB.

(C) A MINIMUM 1/2" WIDTH OF PREFORMED EXPANSION JOINT FILLER SHALL BE PLACED BETWEEN THE CURB OR GUTTER AND ANY CONCRETE PAVEMENT SLAB.

(D) A MINIMUM 1/2" WIDTH OF PREFORMED EXPANSION JOINT FILLER SHALL BE PLACED BETWEEN THE CURB AND SIDEWALK OR ANY SOLID STRUCTURE.

(E) PREFORMED EXPANSION JOINT FILLER SHALL COMPLY WITH THE REQUIREMENTS OF AASHTO M-33 OR M-153.

RADII:

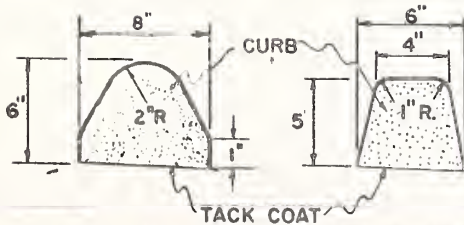
MINIMUM CURB RETURN RADII - 10' .

15' RADII DESIRABLE FOR STREETS AND ALLEYS.

CONCRETE:

UNLESS OTHERWISE SPECIFIED, CONCRETE CURBS AND CONCRETE INTEGRAL CURB AND GUTTER SHALL BE CONSTRUCTED OF AIR-ENTRAINED CLASS "DD" CONCRETE OR EQUAL.

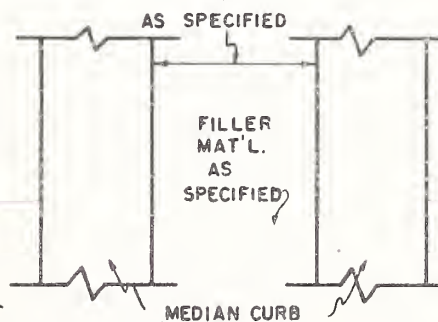
BITUMINOUS CURBS



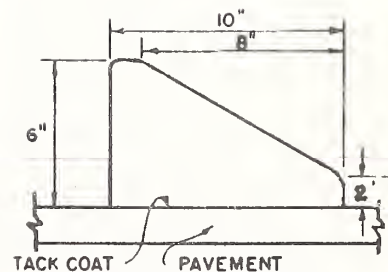
THE CONTRACTOR MAY USE EITHER THE 6" OR THE 8" CURB.

CURB SECTION

#1 CU. FT. OF MATERIAL WILL MAKE ABOUT 5 LINEAR FT. OF CURB.



MEDIAN CURB



MEDIAN CURB SECTION

#1 CU. FT. OF MATERIAL WILL MAKE ABOUT 3.5 LINEAR FT. OF CURB.

ALL MATERIALS AND CONSTRUCTION TO CONFORM TO STANDARD SPECIFICATIONS FOR BITUMINOUS CURB.

NOTE TO DESIGNERS:

* QUANTITIES SHOWN ABOVE ARE FOR ESTIMATING PURPOSES ONLY.
THE ABOVE DETAILS TO SERVE AS AN EXAMPLE ONLY.
DESIGN TO FIT SPECIFIC CONDITIONS. SEE PLANS FOR DETAILS AND QUANTITIES. USE LOCAL STANDARDS WHERE AVAILABLE.

State Highway Commission
Helena, Montana

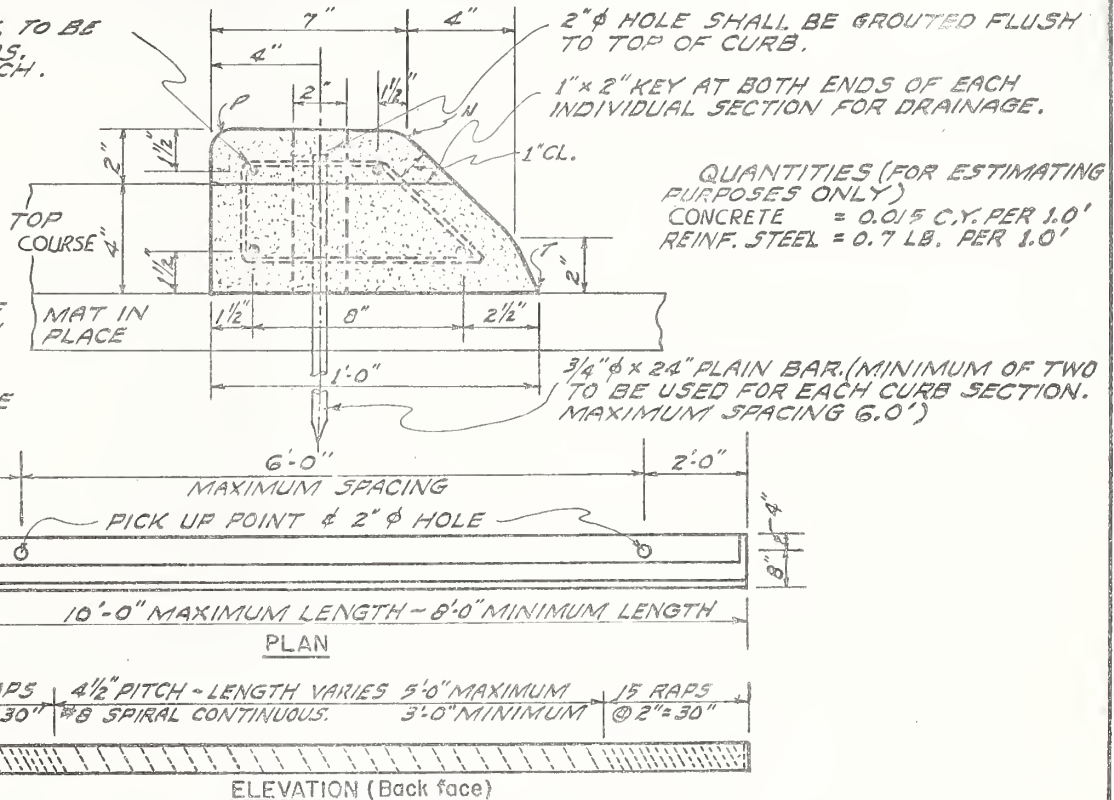
CONCRETE MEDIAN CURBS

Approved
James M. Ruffert 11-22-68
State Highway Engineer

PRECAST-PRESTRESSED CONCRETE MEDIAN CURB (TYPE "A")

REINFORCE WITH 4 - $\frac{1}{4}$ " ϕ BARS, TO BE CUT $\frac{1}{2}$ " BACK FROM FACE AT ENDS. JACKING LOAD = 3.1 TONS EACH.

NOTES:- CURBS TO BE CAST IN INVERTED POSITION. CLASS "DD" CONCRETE OR EQUAL, TYPE III CEMENT TO BE USED THROUGHOUT. PATCH HOLE WITH EPOXY GLUE TRETOL NO. T385 MIXED WITH FOUR VOLUMES CLEAN SHARP SAND. ALL EXPOSED EDGES SHALL BE ROUNDED $\frac{3}{4}$ " RADIUS. CONCRETE - 4000 PSI @ TRANSFER.



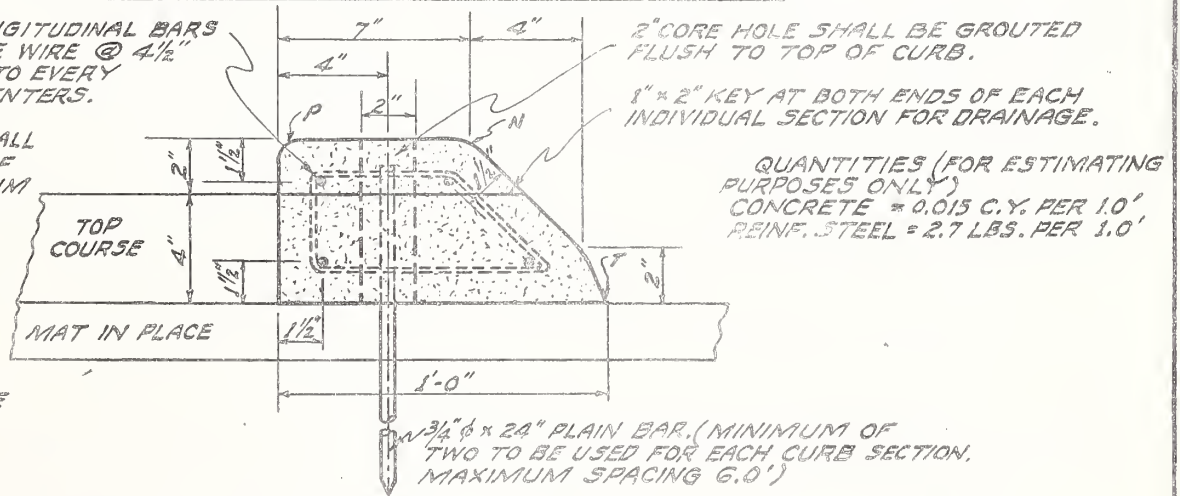
PRECAST CONCRETE MEDIAN CURB (TYPE "A" - Mat in place)

REINFORCE WITH 4 - #4 LONGITUDINAL BARS AND WRAP WITH 8-GAGE WIRE @ 4 1/2" PITCH. TIE 8-GAGE WIRE TO EVERY REINFORCING BAR @ 2' CENTERS.

NOTES:- MEDIAN CURBS SHALL BE PRECAST A MINIMUM OF 4' LENGTHS AND A MAXIMUM OF 10' LENGTHS.

ALL EXPOSED EDGES SHALL BE ROUNDED $\frac{3}{4}$ " RADIUS.

TYPES "A" & "B" CONCRETE SHALL BE CLASS "DD" OR CONCRETE OF EQUAL STRENGTH.



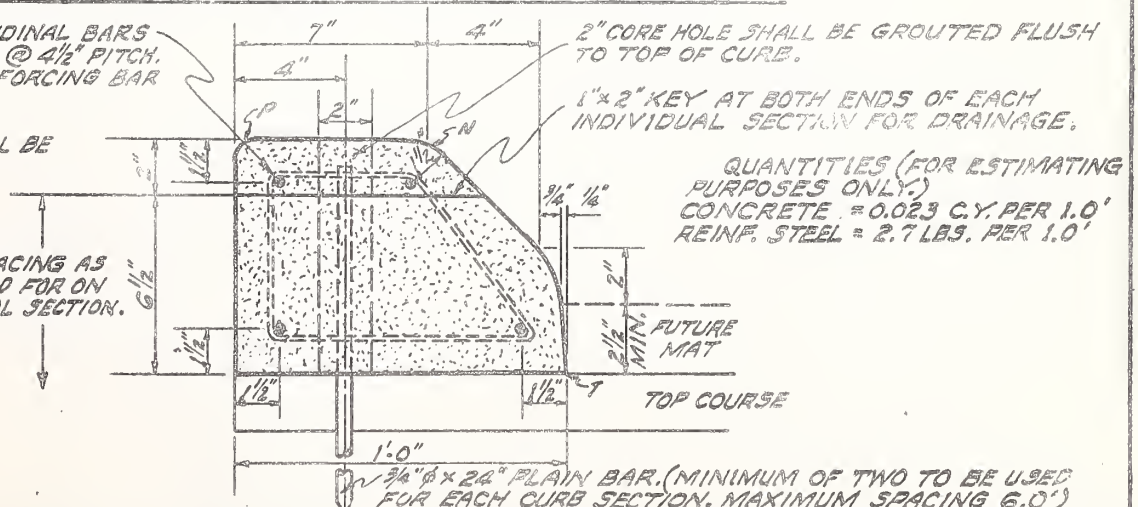
PRECAST CONCRETE MEDIAN CURB (TYPE "B" - Future mat)

REINFORCE WITH 4 - #4 LONGITUDINAL BARS AND WRAP WITH 8-GAGE WIRE @ 4 1/2" PITCH. TIE 8-GAGE WIRE TO EVERY REINFORCING BAR @ 2' CENTERS.

NOTES:- MEDIAN CURBS SHALL BE PRECAST A MINIMUM OF 4' LENGTHS AND A MAXIMUM OF 10' LENGTHS.

ALL EXPOSED EDGES SHALL BE ROUNDED $\frac{3}{4}$ " RADIUS.

SURFACING AS CALLED FOR ON TYPICAL SECTION.



REVISED	3-1-66	11-20-68
EFFECTIVE	3-1-66	1-1-69

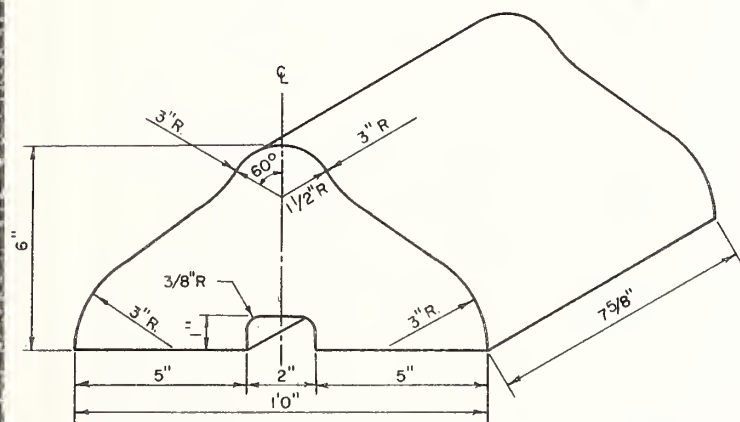
STANDARD DRAWING NO. 75-03

State Highway Commission
Helena, Montana

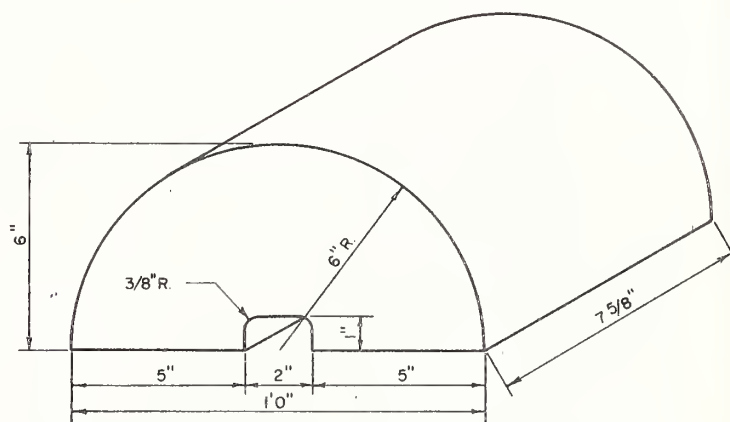
PRECAST TRAFFIC CURB

Approved

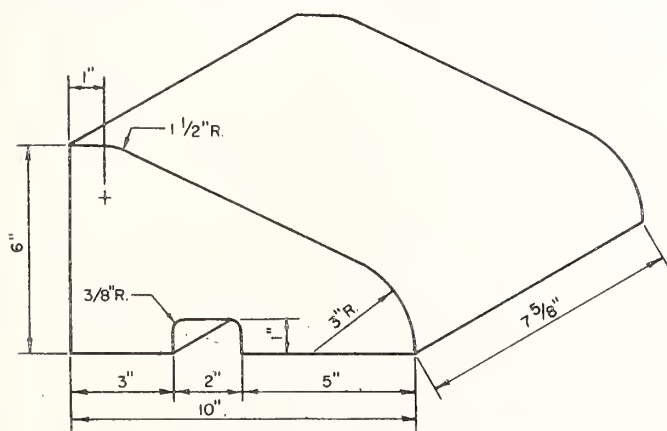
James W. Sullivan 12-7-68
State Highway Engineer



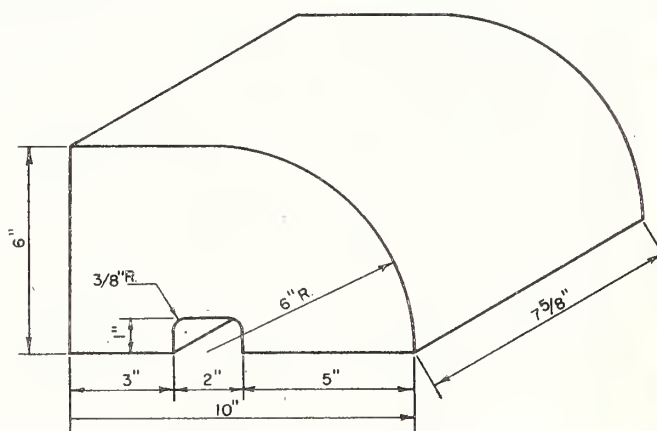
TYPE I BLOCK



TYPE I REFLECTOR BLOCK



TYPE II BLOCK



TYPE II REFLECTOR BLOCK

NOTES:

Every sixth block shall be a reflector block, unless otherwise specified.

Concrete shall be Class "DD" or concrete of equal strength.

Blocks shall be set with approved Portland cement grout or with an approved adhesive agent.

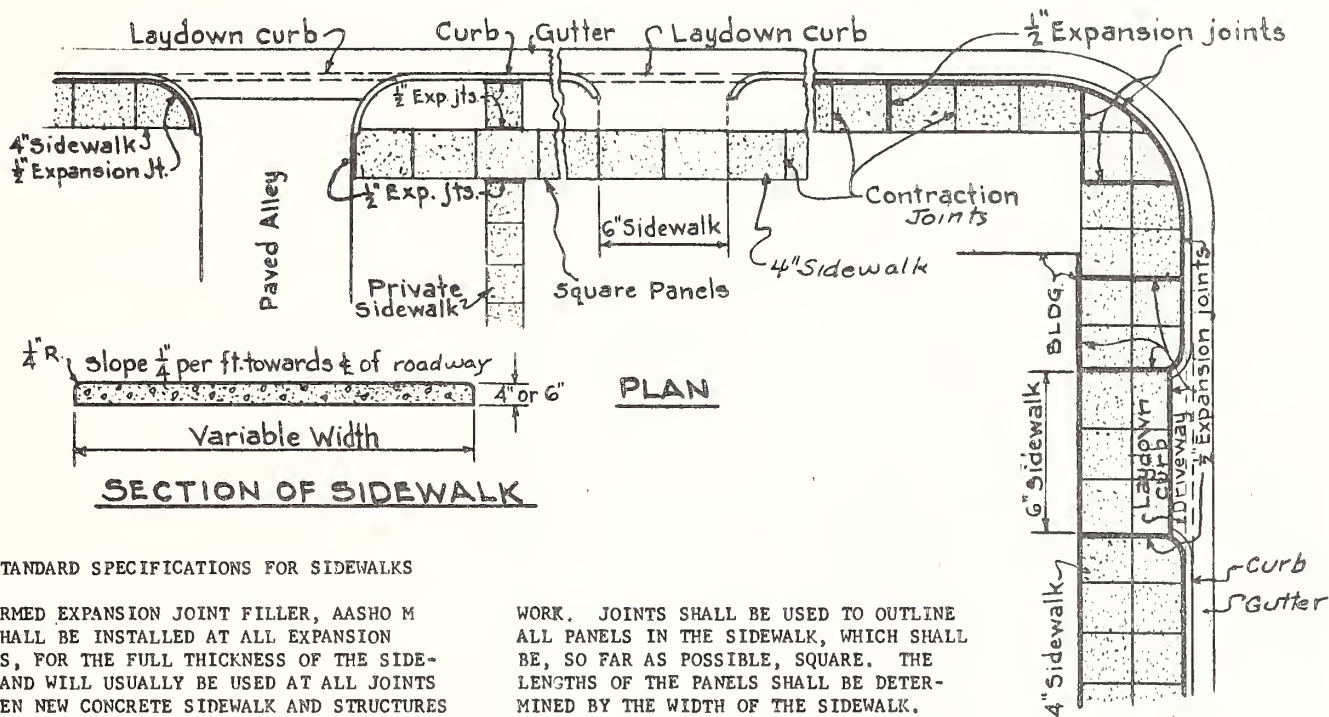
REVISED 9-1-59 11-20-68
EFFECTIVE 9-1-59 1-1-69

STANDARD DRAWING NO. 76-01

State Highway Commission
Helena, Montana

CONCRETE SIDEWALK

Approved
James M. Shuttles R. 916B
State Highway Engineer



SEE STANDARD SPECIFICATIONS FOR SIDEWALKS

PREFORMED EXPANSION JOINT FILLER, AASHO M 33, SHALL BE INSTALLED AT ALL EXPANSION JOINTS, FOR THE FULL THICKNESS OF THE SIDEWALK AND WILL USUALLY BE USED AT ALL JOINTS BETWEEN NEW CONCRETE SIDEWALK AND STRUCTURES IN PLACE. PREFORMED EXPANSION JOINT FILLER SHALL BE INCLUDED IN THE UNIT PRICE BID PER SQUARE YARD FOR CONCRETE SIDEWALK.

ALL JOINTS SHALL BE STRAIGHT AND PERPENDICULAR TO THE CENTERLINE AND THE SURFACE OF THE SIDEWALK. ALL JOINTS, WHERE PRACTICABLE, SHALL ALIGN WITH LIKE JOINTS IN ADJOINING

WORK. JOINTS SHALL BE USED TO OUTLINE ALL PANELS IN THE SIDEWALK, WHICH SHALL BE, SO FAR AS POSSIBLE, SQUARE. THE LENGTHS OF THE PANELS SHALL BE DETERMINED BY THE WIDTH OF THE SIDEWALK.

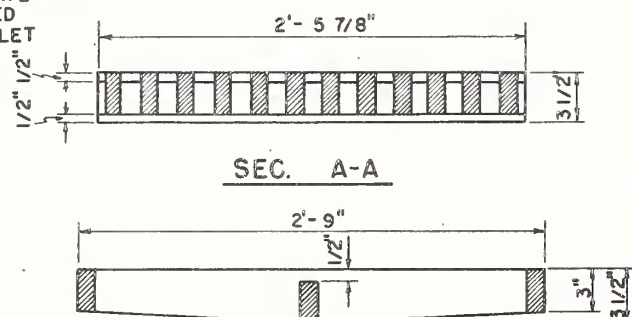
CONTRACTION JOINTS SHALL BE NOT MORE THAN 1/8 INCH WIDE AND NOT LESS THAN 1 INCH IN DEPTH AND MAY BE CUT BY A GROOVE FORMING TOOL.

EXPANSION JOINTS AT THE NEAREST MULTIPLE OF THE CONTRACTION JOINT INTERVAL BUT NOT TO EXCEED 60 FEET.

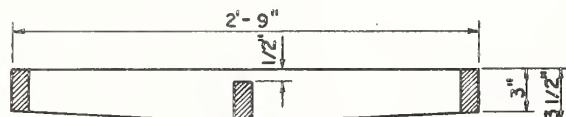
STANDARD DRAWING NO. 77-02

DROP INLET BOXES & COVER

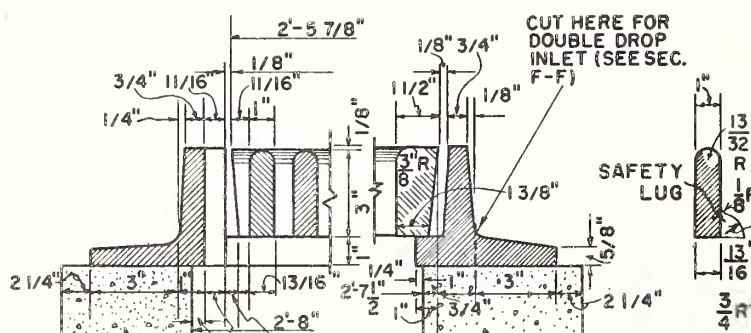
Approved _____
State Highway Engineer



SEC. A-A



SEC. B-B



SEC. C-C

SEC. D-D

SEC. E-E

DETAIL - DROP INLET COVER

**NOTE: GRATE TO BE INSTALLED WITH
BARS PARALLEL TO INTAKE FLOW.**

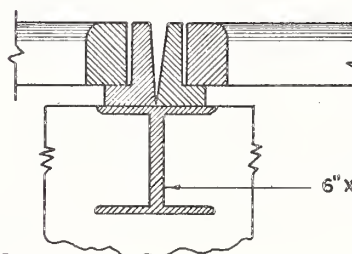
NOTE: ALL CONCRETE TO BE CLASS "DD" OR EQUAL. THESE DETAILS TO SERVE AS AN EXAMPLE ONLY. DESIGNERS WILL DESIGN TO FIT SPECIFIC CONDITIONS. SEE PLANS FOR DETAILS & QUANTITIES. USE LOCAL STD'S. WHERE AVAILABLE.

* QUANTITIES

DOUBLE DROP	CONCRETE	Rein. Steel
	1.5 CU. YDS.	145 LBS.
SINGLE DROP	1.0 CU. YDS.	90 LBS.

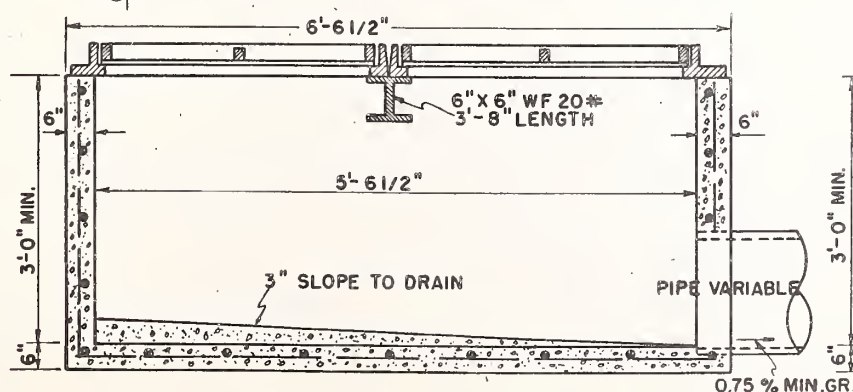
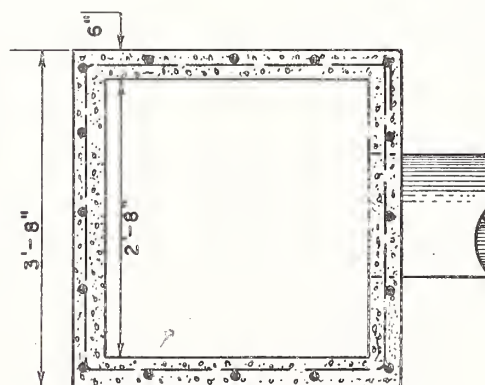
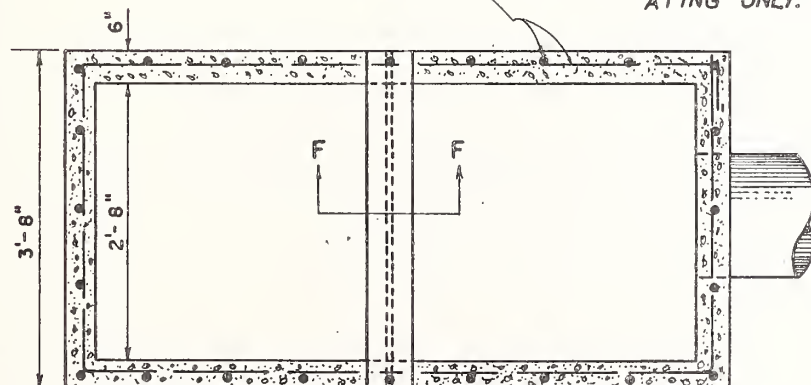
4 BARS AT 12" CTRS.
MAXIMUM-SPACED
EQUALLY.

QUANTITIES
ARE FOR ESTIM-
ATING ONLY.

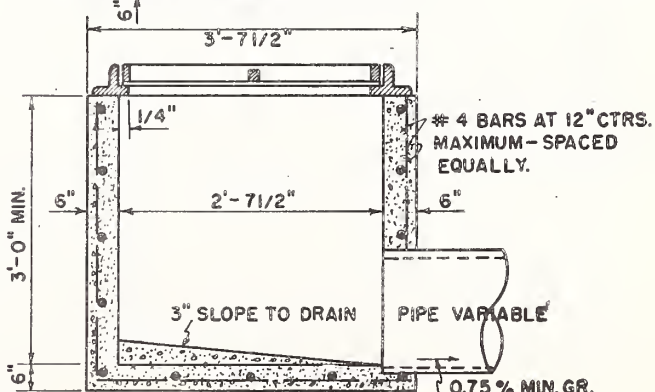


SECTION F-f
FOR DOUBLE INLET

6" X 6" WF 20 # 3'-8" LENGTH



DOUBLE DROP INLET



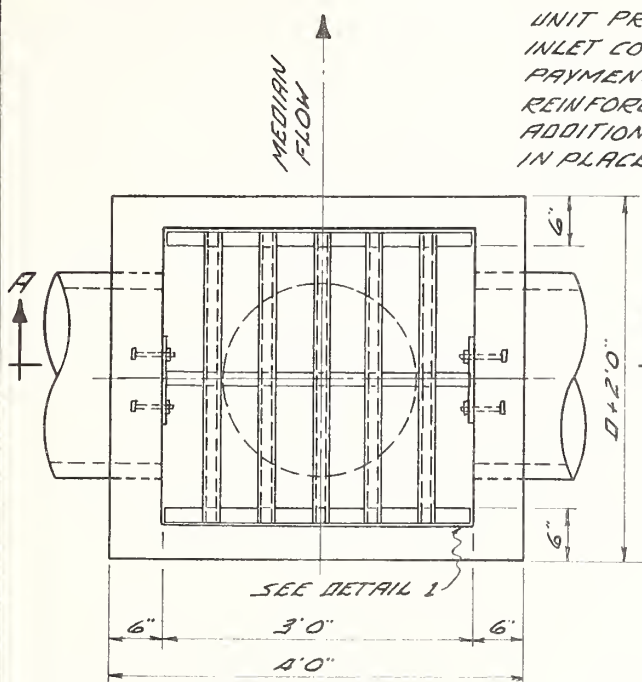
SINGLE DROP INLET

STANDARD DRAWING NO. 77-03

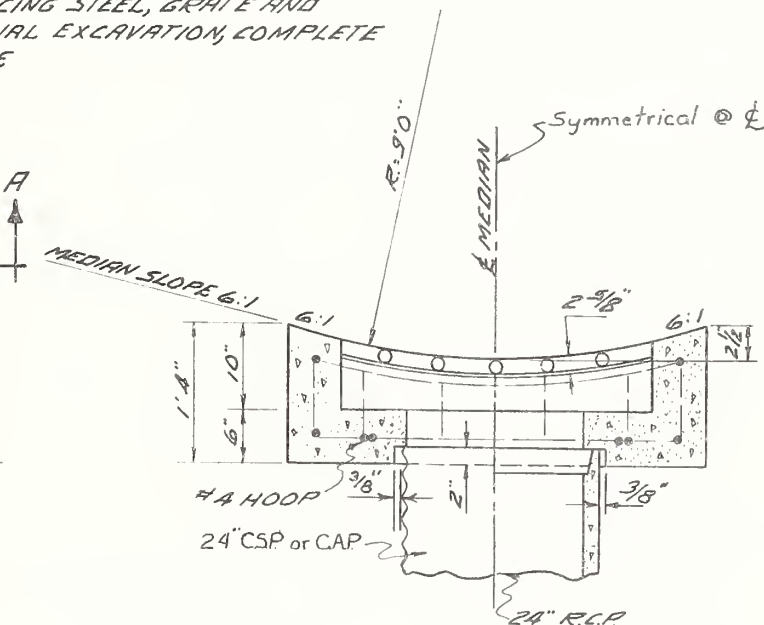
MEDIAN INLET COVER

Approved
Louis W. Phillips
State Highway Engineer

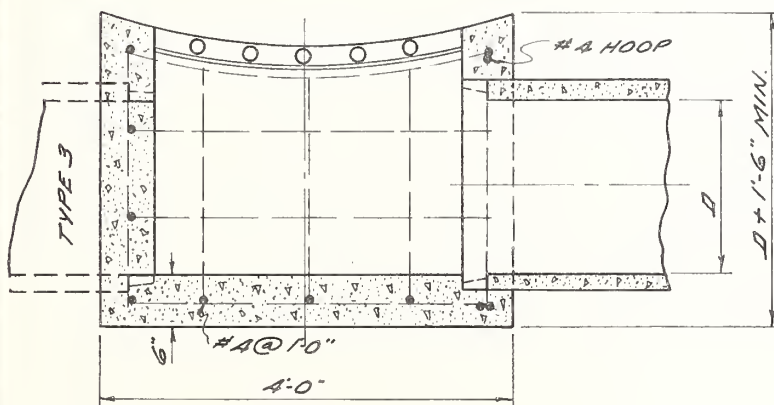
UNIT PRICE BID FOR MEDIAN
INLET COVER SHALL INCLUDE
PAYMENT FOR THE CONCRETE,
REINFORCING STEEL, GRATE AND
ADDITIONAL EXCAVATION, COMPLETE
IN PLACE



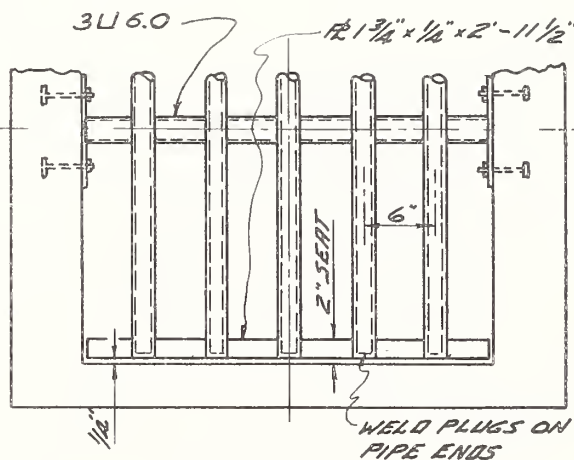
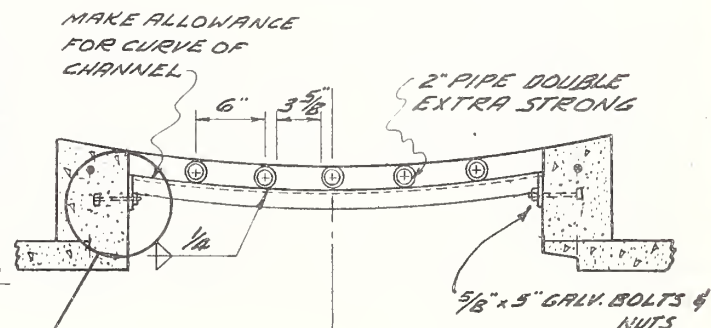
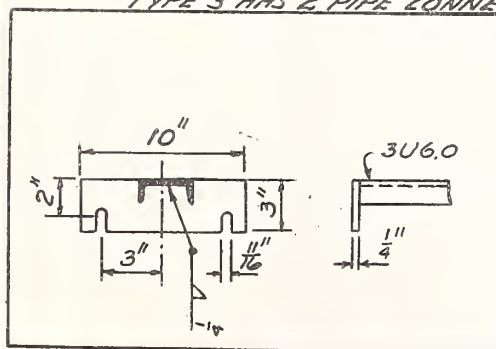
PLAN VIEW
TYPICAL FOR TYPES 1, 2, & 3



SECTION A-A
TYPE 1



SECTION A-A
TYPE 2 & 3 ~ R.C.P., C.S.P. OR C.A.P.
TYPE 2 HAS 1 PIPE CONNECTION
TYPE 3 HAS 2 PIPE CONNECTIONS



DETAIL 1

*CL'DD" CONC. OR EQUAL			
TYPE	24"	30"	36"
1	5 YD ³	~	~
2	9 YD ³	11 YD ³	13 YD ³
3	9 YD ³	10 YD ³	11 YD ³

* QUANTITIES ARE FOR ESTIMATING PURPOSES ONLY. TYPE 3 WILL BE A SPECIAL CASE TO BE FIGURED FOR THE PARTICULAR INSTALLATION

NOTE: ALL EXPOSED METAL PARTS
TO BE PAINTED WITH ONE COAT
OF RED LEAD AND TWO COATS
OF ALUMINUM PAINT.

*GRATE & REINF. STEEL			
	24"	30"	36"
TYPE 1	50 LBS.	~	~
TYPE 2	85 LBS.	95 LBS.	105
TYPE 3	*85 LBS.	*95 LBS.	*105
GRATE	165 LBS.	185 LBS.	210 LBS.

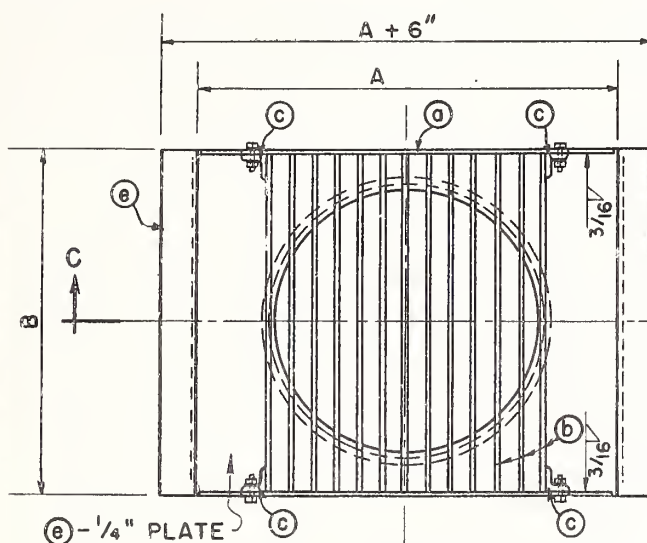
REVISED 7-1-61 11-20-68
EFFECTIVE 7-1-61 1-1-69

STANDARD DRAWING NO. 77-04

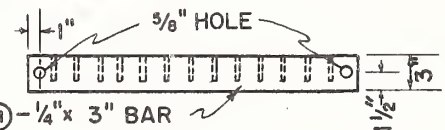
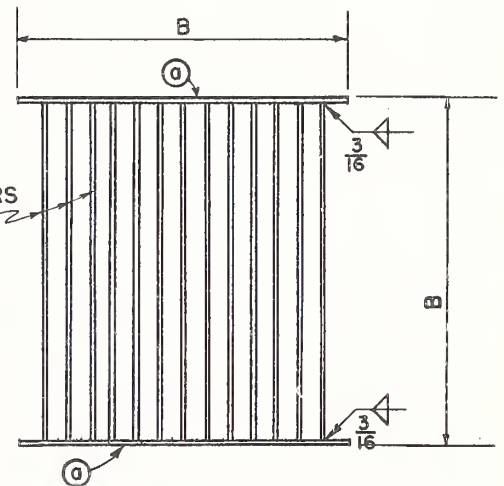
State Highway Commission
Helena, Montana

MEDIAN INLET COVER TYPE "A" FOR METAL RISER

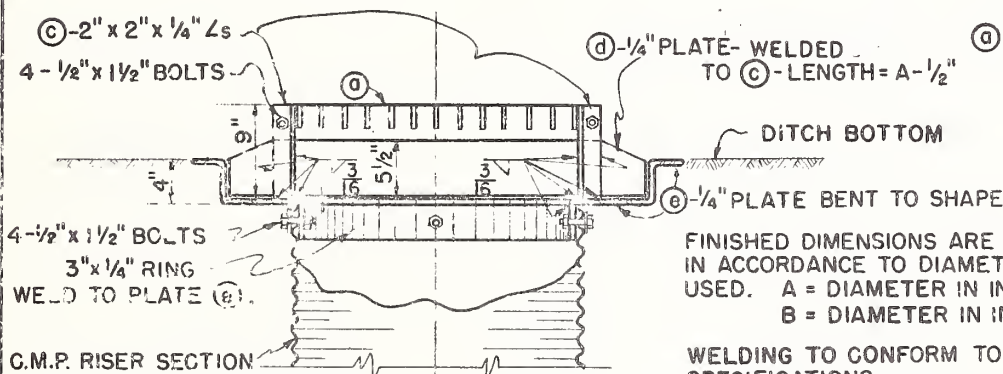
Approved
J. M. Sullivan 12-7-68
State Highway Engineer



PLAN



GRATE DETAIL



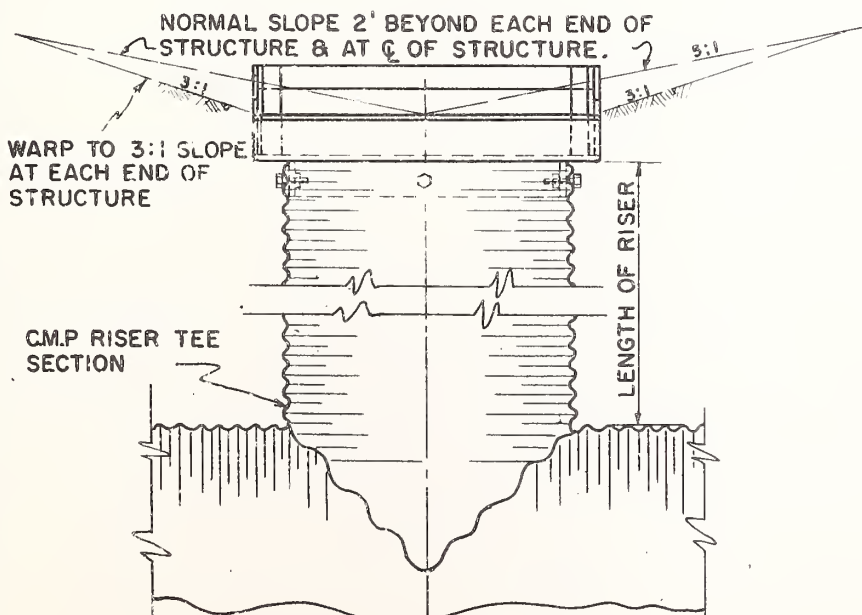
SECTION C-C

FINISHED DIMENSIONS ARE COMPUTED IN ACCORDANCE TO DIAMETER OF C.M.P. USED. A = DIAMETER IN INCHES + 12". B = DIAMETER IN INCHES + 6".

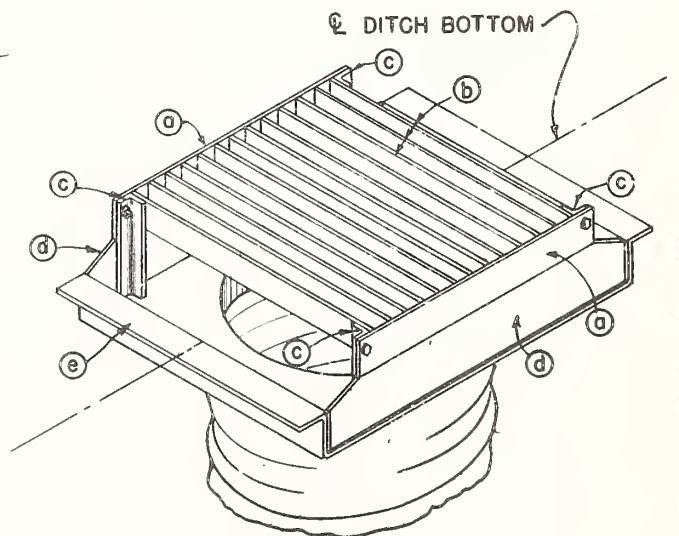
WELDING TO CONFORM TO SECTION ____ OF THE STANDARD SPECIFICATIONS.

ALL BOLTS TO BE GALVANIZED.

PAINTING TO CONSIST OF ONE SHOP COAT OF ZINC CHROMATE OR RED LEAD AND TWO COATS OF ALUMINUM PAINT



FRONT ELEVATION



REVISED 5-1-63 11-20-68
EFFECTIVE 5-1-63 1-1-69

STANDARD DRAWING NO. 77-05

State Highway Commission
Helena, Montana

PRECAST CONCRETE MANHOLE

Approved

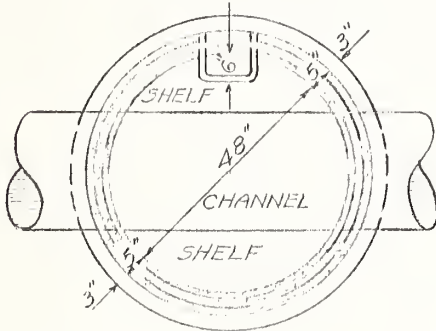
Lawrence J. Sullivan 12-9-68
State Highway Engineer

THE ECCENTRIC CONE PRECAST TOP WILL BE PERMITTED WHEN ITS USE WILL BE AS GOOD OR BETTER THAN THE ONES SHOWN, OR IF IT IS MORE ADAPTABLE TO EXISTING CONDITIONS.

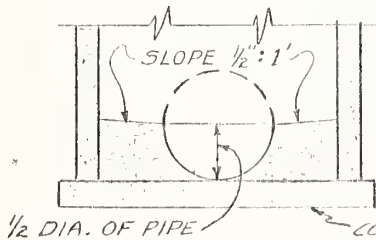
* MINIMUM HEIGHT FOR RING AND COVER IS 4.0 DIES RING AND COVER SHALL BE TOOK TO A MACHINE 1 IN.

ANY OTHER TYPE OF MANHOLE REQUIRED WILL BE DESIGNED AND DESIGNATED AS "SPECIAL MANHOLE".

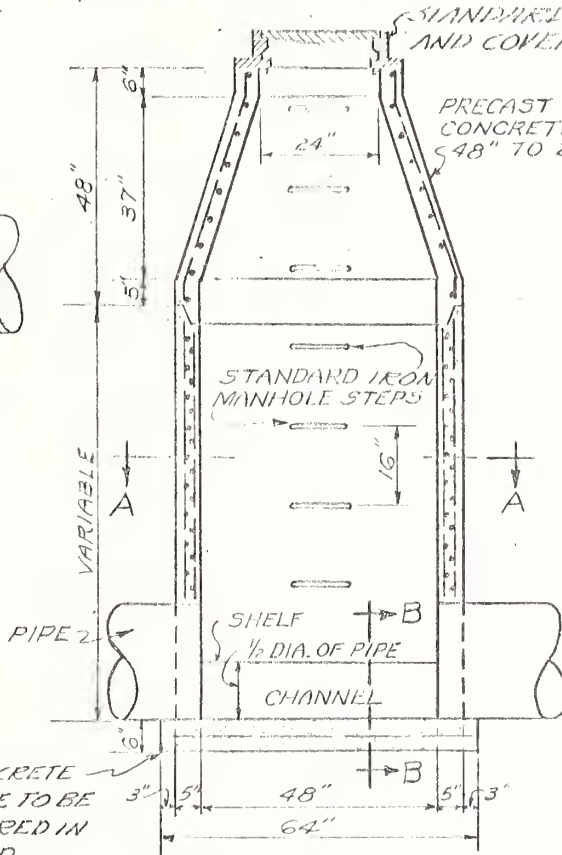
A.S.T.M. C 478 PROVIDES FOR 4000 PSI CONCRETE. THE MIX CALLS FOR 6 SACKS OF CEMENT / CU. YD.



SECTION A-A



SECTION B-B



ELEVATION

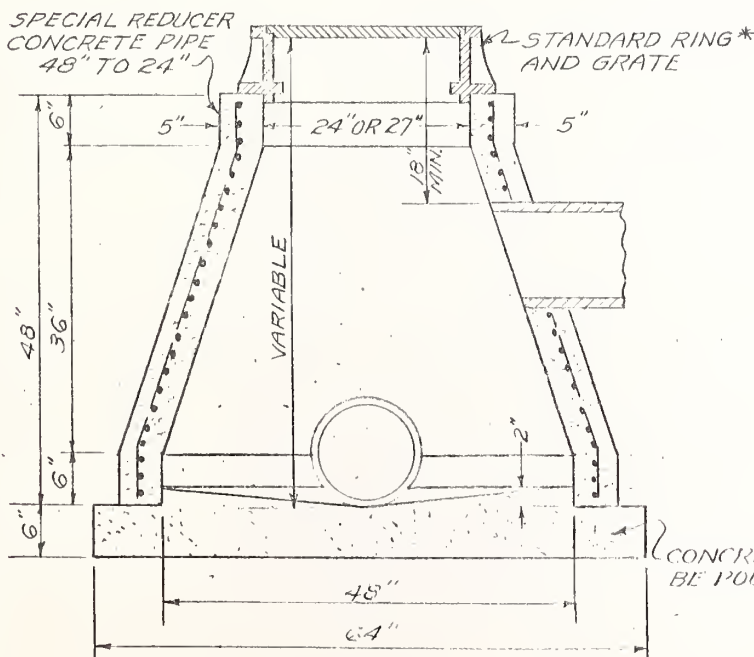
TYPE 1 MANHOLE

REINFORCEMENT SHOWN HERE ON IS ILLUSTRATIVE ONLY. SEE A.S.T.M. C 478

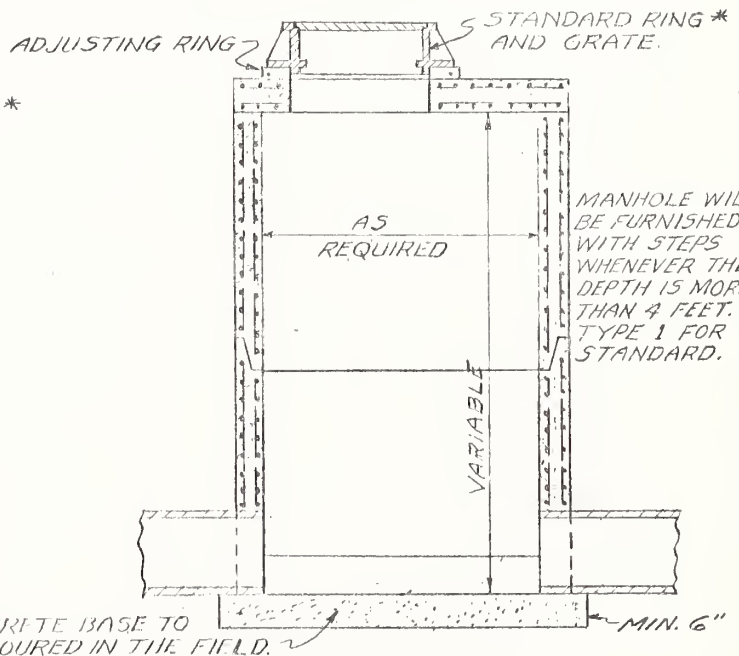
NOTES: UPPER PART TO BE SPECIAL SECTION TO REDUCE DIAMETER FROM 48" TO 24". BOTTOM OF LOWER SECTION TO BE CUT SQUARE TO FIT BASE. GROUT JOINT BETWEEN BASE AND WALL. A GROUT CONSISTING OF ONE PART PORTLAND CEMENT AND TWO PARTS APPROVED SAND MAY BE USED; AN APPROVED PRE-MIXED GROUT, AVAILABLE COMMERCIALY, MAY BE USED.

ALL MANHOLE CONSTRUCTION, EXCEPTING RING, COVER, AND BASE, SHALL CONFORM TO A.S.T.M. C 478. THIS PROVIDES THAT REINFORCEMENT MAY BE MADE OF (1) COLD DRAWN STEEL WIRE - A.S.T.M. A 82, (2) STEEL WIRE FABRIC - A.S.T.M. A 185, OR (3) STEEL BARS - A.S.T.M. A 15

THE CONSTRUCTION AND REINFORCEMENT OF THE BASE FOR EACH TYPE SHALL BE COMPATIBLE WITH THE CONDITIONS AND THE WEIGHT OF THE SUPERSTRUCTURE.



TYPE 2 MANHOLE



TYPE 3 MANHOLE

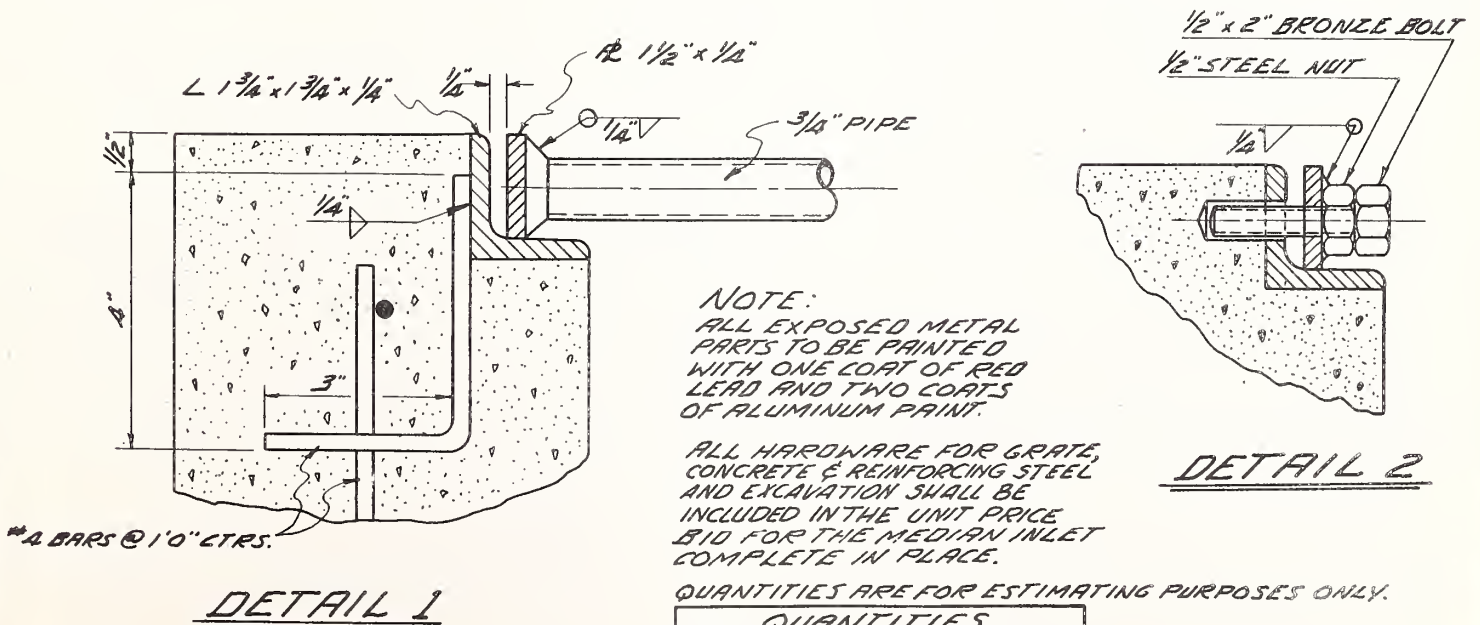
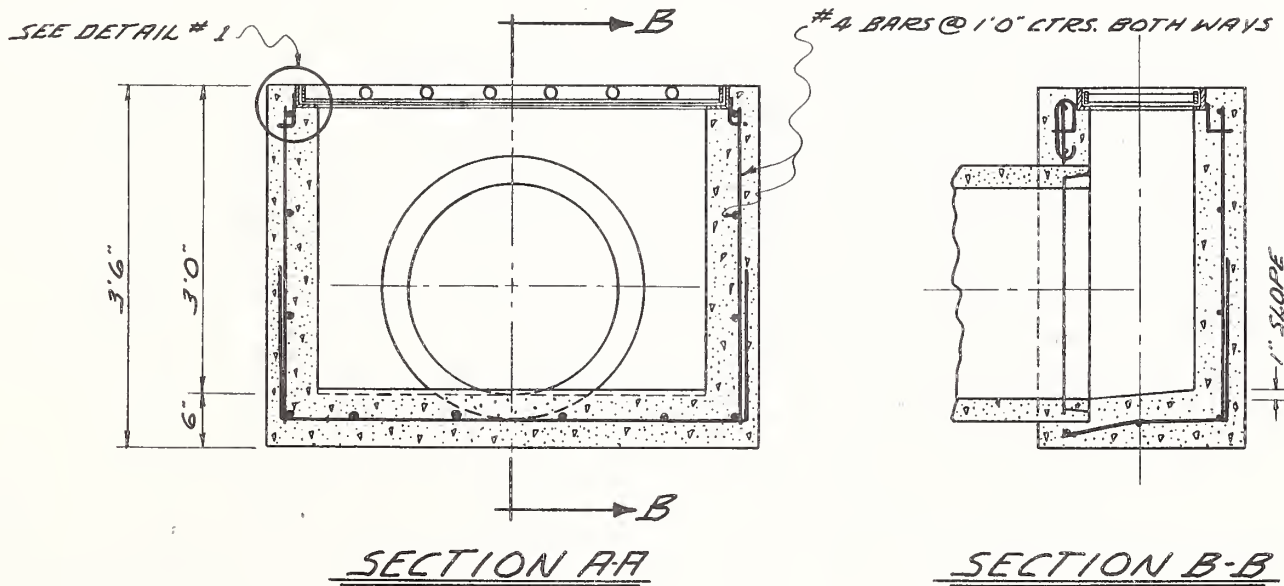
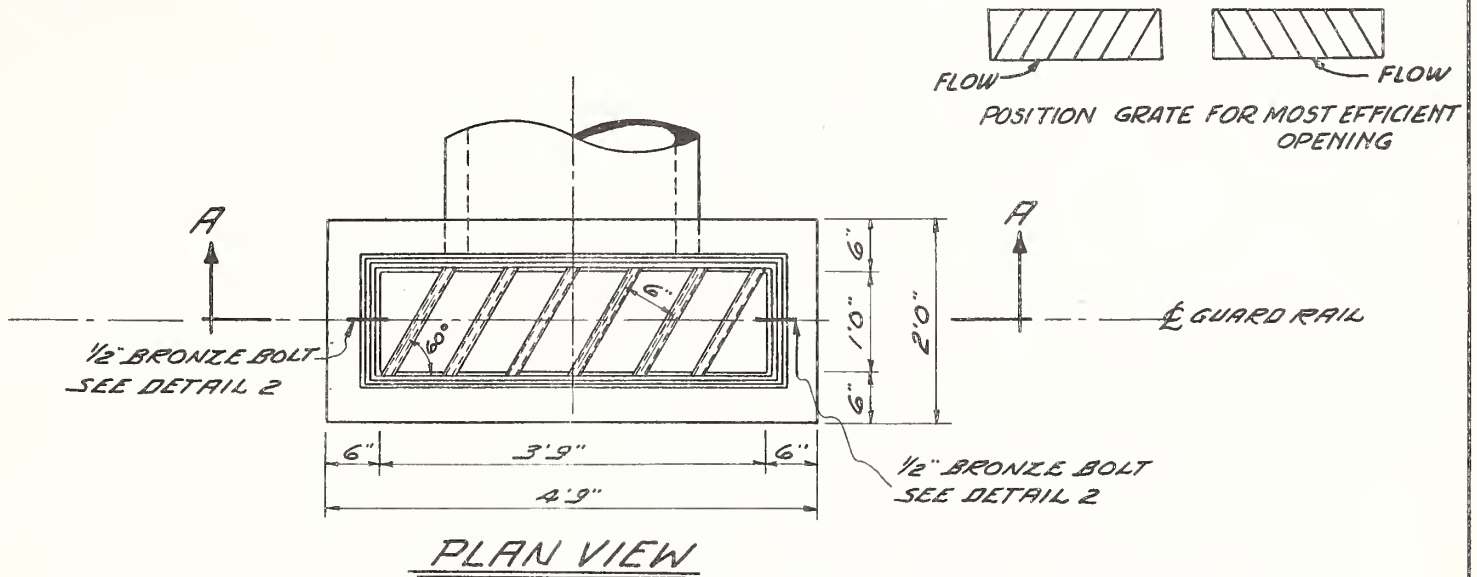
REVISED 8-1-67 11-20-68
EFFECTIVE 8-1-67 1-1-69

STANDARD DRAWING NO. 77-07

State Highway Commission
Helena, Montana

MEDIAN INLET - 10.0 FT. MEDIAN

Approved
James M. Ketter
State Highway Engineer



NOTE:
ALL EXPOSED METAL PARTS TO BE PAINTED WITH ONE COAT OF RED LEAD AND TWO COATS OF ALUMINUM PAINT.

ALL HARDWARE FOR GRATE, CONCRETE & REINFORCING STEEL AND EXCAVATION SHALL BE INCLUDED IN THE UNIT PRICE BID FOR THE MEDIAN INLET COMPLETE IN PLACE.

QUANTITIES ARE FOR ESTIMATING PURPOSES ONLY.

QUANTITIES	
REINF. STEEL	7.5 LBS.
CL. DD CONC. OR EQUAL	.75 CU. YDS.

REVISED 9-1-66 11-22-68
EFFECTIVE 9-1-66 1-1-69

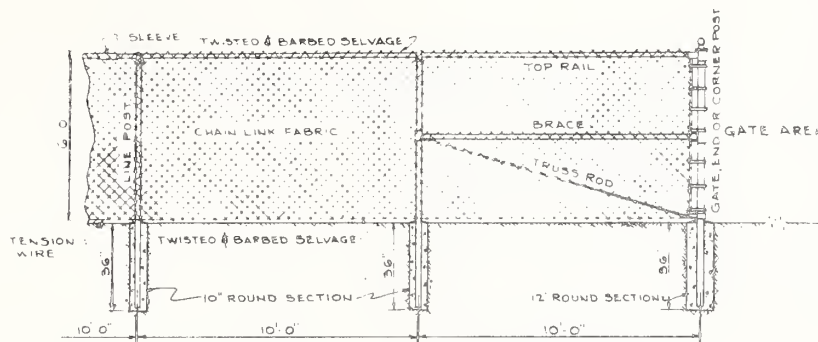
STANDARD DRAWING NO. 80 - 01

State Highway Commission
Helena, Montana

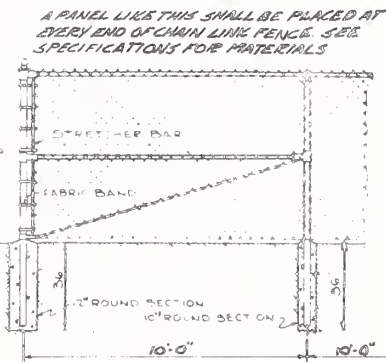
CHAIN LINK FENCE

Approved

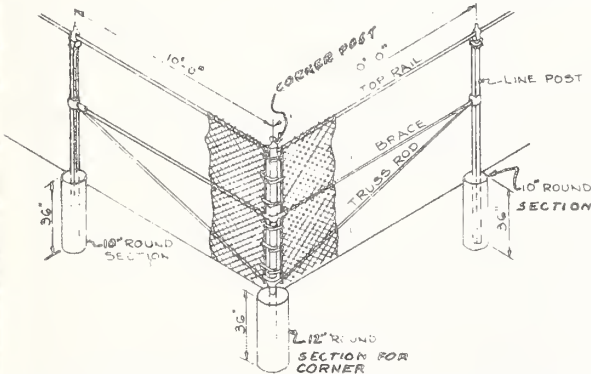
James C. Miller 10-24-68
State Highway Engineer



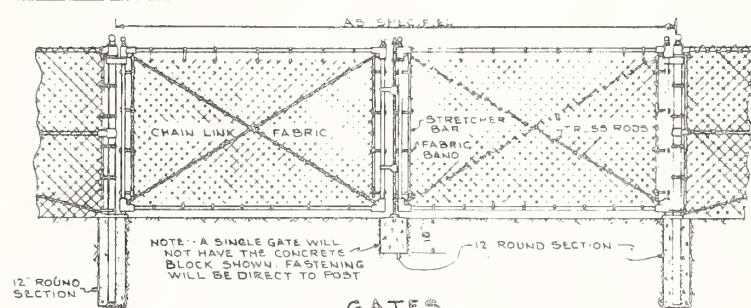
6' CHAIN LINK FENCE



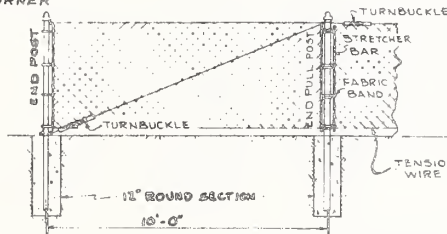
SINGLE PANEL



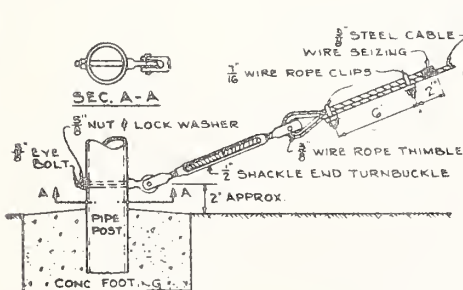
DOUBLE PANEL
Pull post and corner
post bracing.



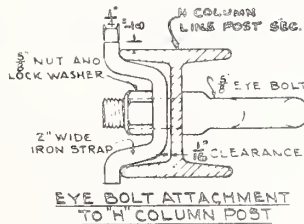
GATES
FOR USE WITH FENCE WHEN SPECIFIED



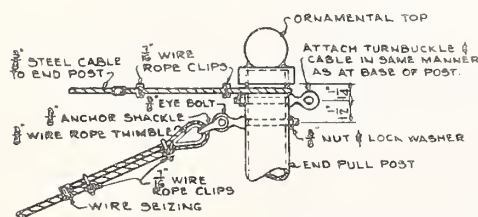
CHAIN LINK FENCE - 3', 4' & 5'



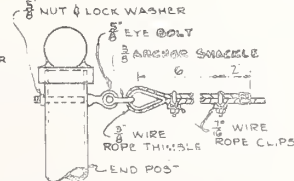
DETAIL FOR FASTENING
CABLE TO BASE OF POST



EYE BOLT ATTACHMENT
TO H-COLUMN POST



DETAIL OF TOP CABLE ATTACHMENT
FOR END PULL POST



DETAIL OF TOP CABLE
ATTACHMENT FOR END POST

CABLE ATTACHMENT DETAILS
for 3 ft., 4 ft. & 5 ft. fence

SEE STANDARD SPECIFICATIONS FOR FURTHER REQUIREMENTS.

GATES ARE INCLUDED ON THIS STANDARD FOR USE IN SPECIAL CASES ONLY. THEY SHALL NOT BE INSTALLED AT ANY LOCATION UNLESS SPECIFIED BY THE ENGINEER.

LINE POSTS ON 3 FOOT AND 4 FOOT FENCE, OTHER THAN THE TWO POSTS ADJACENT TO PULL POSTS, NEED NOT BE SET IN CONCRETE BUT MAY BE DRIVEN OR DRILLED INTO SOLID EARTH.

PULL POST BRACING ON 6 FOOT FENCE SHALL BE SAME AS CORNER BRACING SHOWN IN DETAIL UPPER LEFT.

ALL CONCRETE IS CLASS "F" OR BETTER.

THE ESSENTIAL FEATURES SHOWN HEREON ARE APPLICABLE TO ALUMINUM ALLOY FENCE. ALUMINUM ALLOY FENCE WILL NOT USE CABLE AT TOP BUT WILL REQUIRE TOP RAIL FOR ALL HEIGHTS.

DOUBLE PANELS SHALL BE INSTALLED NO MORE THAN 300 FEET APART ON TANGENT AND USED FOR PULLING. SUCH PANELS SHALL BE PLACED AT EACH END OF EACH CURVE SHARPER THAN 5° AND BE APPROXIMATELY EVENLY SPACED BETWEEN, ABOUT 20° OF CENTRAL ANGLE (10° DEFLECTION) APART, BUT NOT MORE THAN 250 FEET APART ON ANY CURVE. SEE SPECIFICATIONS FOR MATERIALS.

HEIGHT OF FABRIC	WIRE FABRIC ABOVE GROUND	DEPTH OF POST IN CONCRETE	POST IN CONC. (MIN.)
6'	1"-2"	36"	32"
5'	1"-2"	36"	32"
4'	1"-2"	30"	26"
3'	1"-2"	30"	26"

REVISED 5-1-63 11-1-68 11-1-69
EFFECTIVE 5-1-63 1-1-69 1-1-70

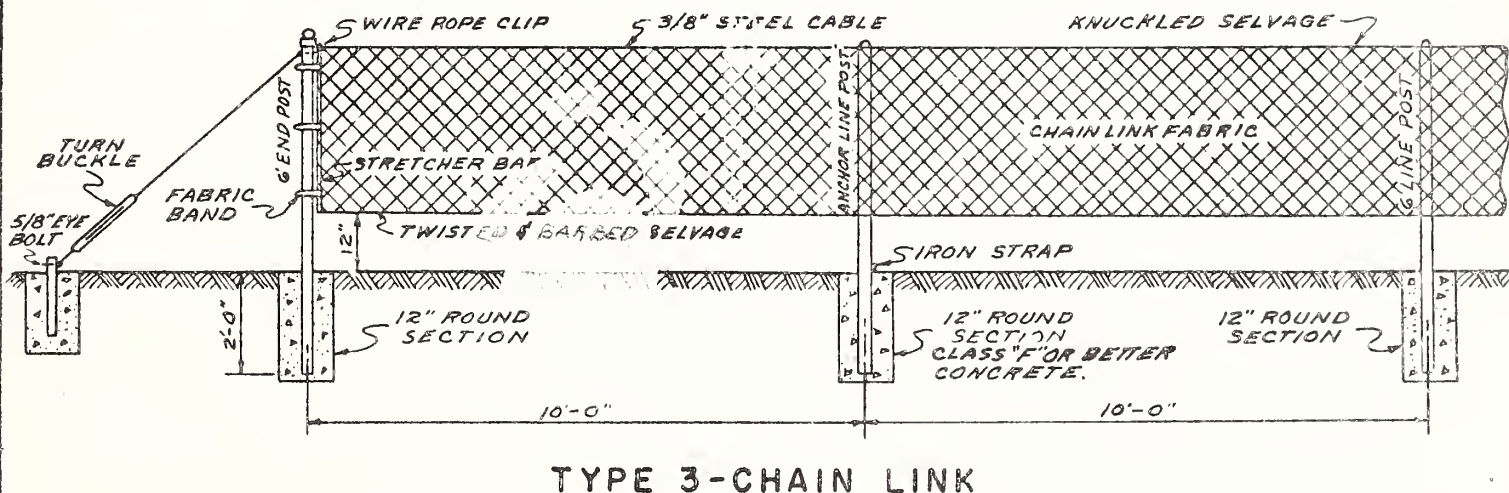
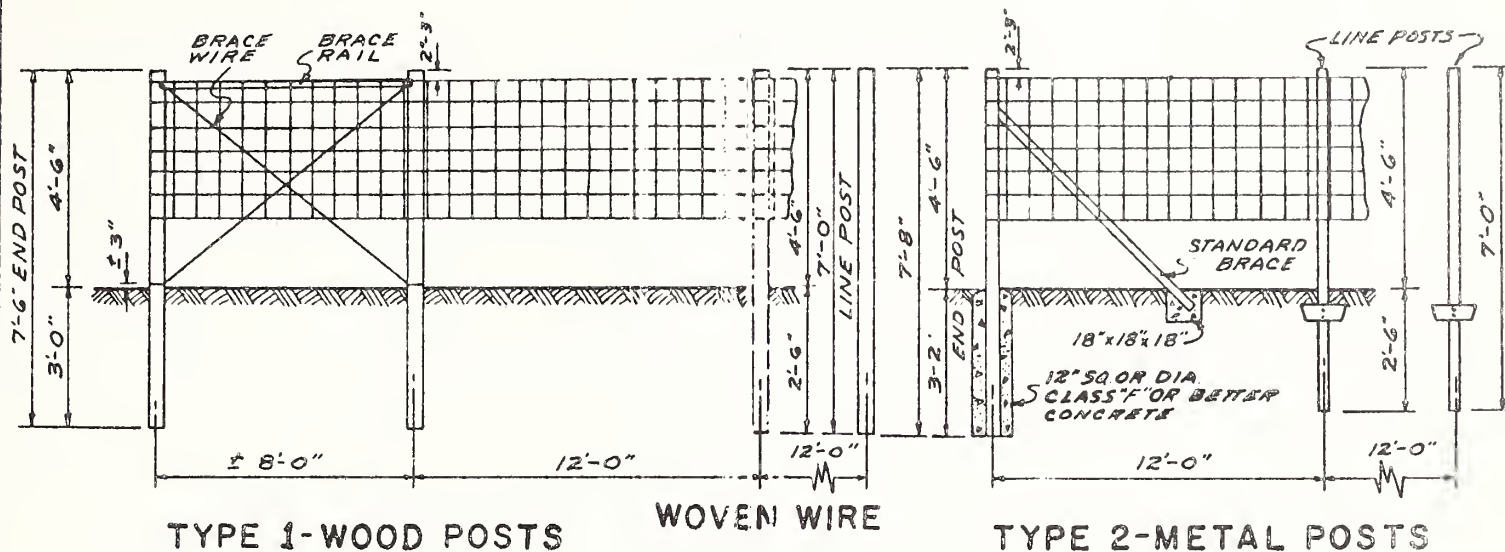
STANDARD DRAWING NO. 80-02

State Highway Commission
Helena, Montana

MEDIAN BARRIER FENCE

Approved

James H. Phillips 10-29-68
State Highway Engineer



WOVEN WIRE MEDIAN BARRIER FENCE

WOVEN WIRE - PART (B) - ARTICLE M-210.02
BRACE WIRE - PART (D) - ARTICLE M-210.02
WOOD POSTS - PART (I) - ARTICLE M-210.02
METAL POSTS - PART (H) - ARTICLE M-210.02
DEADMAN --- PART (K) - ARTICLE M-210.02
CONCRETE MATERIALS TO CONFORM TO STD. SPEC.
CONSTRUCTION IN ACCORDANCE WITH STD. SPEC.

CHAIN LINK MEDIAN BARRIER FENCE

WHEN CHAIN LINK MEDIAN BARRIER FENCE IS SPECIFIED:
REFER TO STANDARD SPECIFICATIONS, FOR
MATERIALS AND CONSTRUCTION
CHAIN LINK FABRIC TO BE GALVANIZED STEEL
TOP RAIL OR CABLE SHALL NOT BE USED.
TOP AND BOTTOM OF WIRE MESH SHALL BE KNUCKLED SELVAGE.

METAL POST SPACING SAME AS WOOD.
SET END POST IN CONCRETE
METAL LINE POSTS TO HAVE STANDARD ANCHOR PLATE
END POSTS TO BE ANGLE STEEL 2½"x2½"x½"

GENERAL NOTES

MAXIMUM SPACING BETWEEN PANELS AND/OR PULL POSTS
SHALL BE APPROXIMATELY 400 FEET ON TYPES 1, 2
AND 3 MEDIAN BARRIER FENCE (LESS IF DIRECTED BY
ENGINEER OR SO SPECIFIED).

SEE STANDARD DRAWING NO. 81-01 FOR OTHER DETAILS
AND FOR DEADMAN.

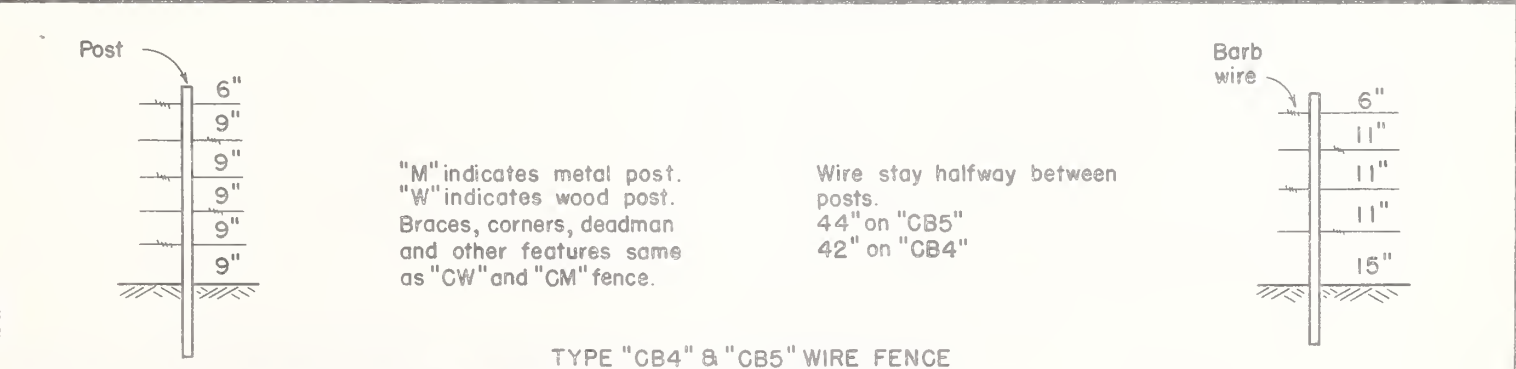
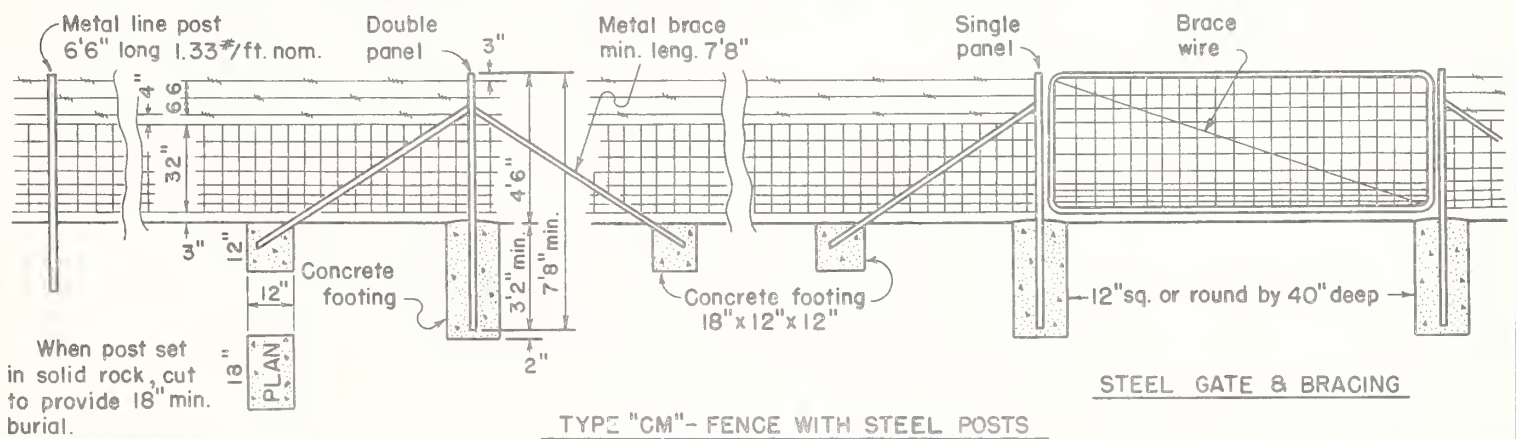
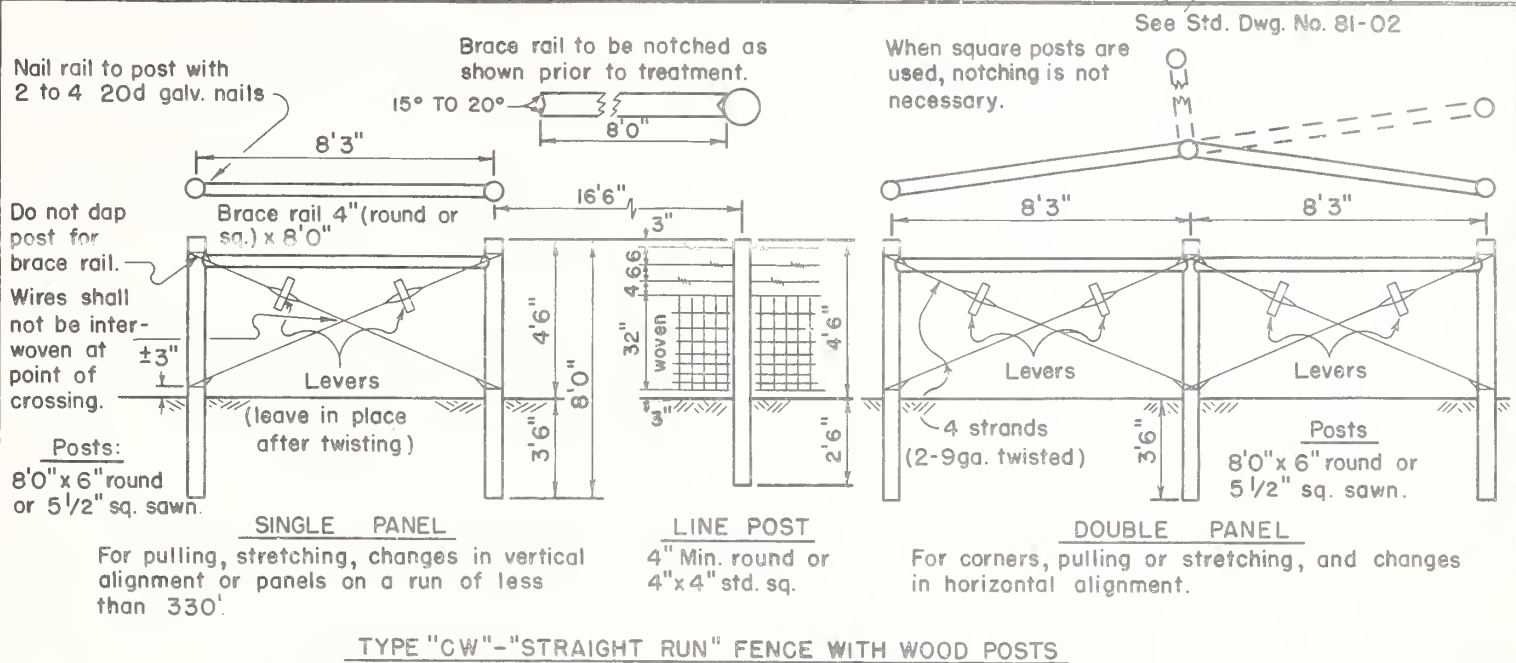
REVISED	9-1-66	11-22-68	9-1-70
EFFECTIVE	9-1-66	1-1-69	1-1-71

STANDARD DRAWING NO. 81-01

State Highway Commission
Helena, Montana

WIRE FENCE - INTERSTATE TYPE

Approved
James D. [Signature]
State Highway Engineer



NOTES:

All fence wire to be placed on pasture side of post except curves, the wire shall be placed on the outside of the curve. In areas subject to high velocity winds and moving debris, wires may all be placed on windward side of posts. Except on curves.

All concrete shall be class "F" or better.

Maximum bow in wood posts -- 2" in 7'.

Post spacing measured generally parallel to ground.

Line post shall normally be spaced 16'6" apart. Also 16'6" from brace or panel posts.

24" wire stay to be placed halfway between posts, excepting panels on "CM" and "CW" fence.

Fence with wooden posts to have one metal post, in place of a wooden line post, in each 500' run for lighting protection.

Type "CW" panels (wood) will be used on type "CM" fence instead of steel panels when so specified.

Steel corner, end, gate and pull post and each brace shall be set in concrete as shown.

"Terminal Post" shall be at the end of any run of wire or at any stretch panel.

A deadman may be a precast concrete block, a cast in place concrete block, a rock or other approved object -- weighing at least 150 lbs -- and covered at least 2 feet.

Staple the bottom, top, center and alternate wires of woven wire to wood line posts.

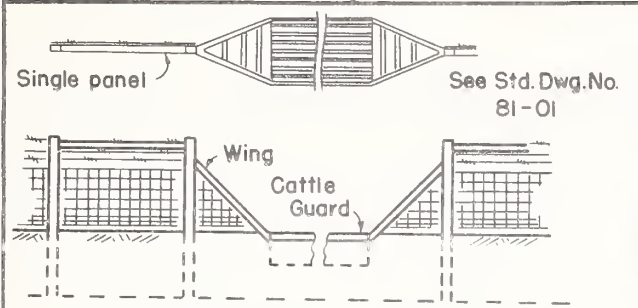
Staple all wires of woven wire to wood corner posts or post used to tie-off wire.

Maximum run between panels see STD. DWG. 81-02.

State Highway Commission
Helena, Montana

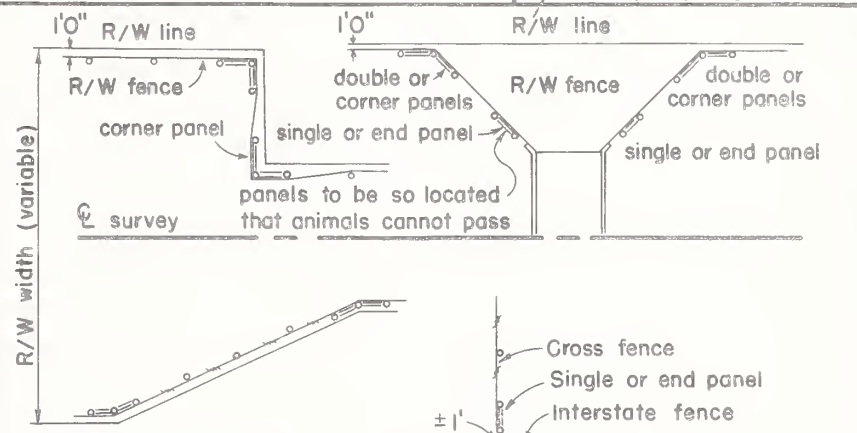
WIRE FENCE - INTERSTATE TYPE

Approved
James H. Patton
State Highway Engineer



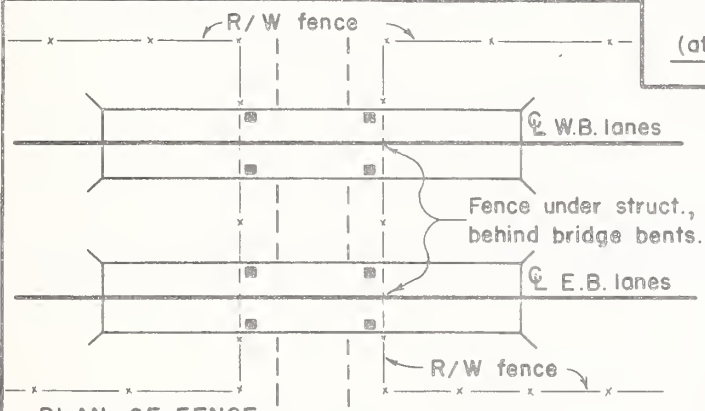
FENCE CONNECTION TO CATTLE GUARD

For detail of cattle guard see standard drawing
Fence wire shall be securely fastened to the wings
and so arranged that animals cannot pass.

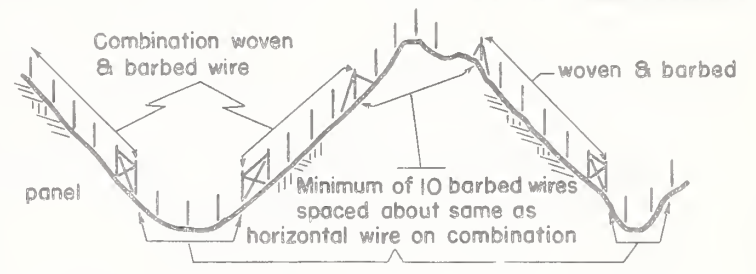


PLAN OF FENCE
(at change in R/W width)

LAYOUT OF CROSS-FENCE CONNECTION

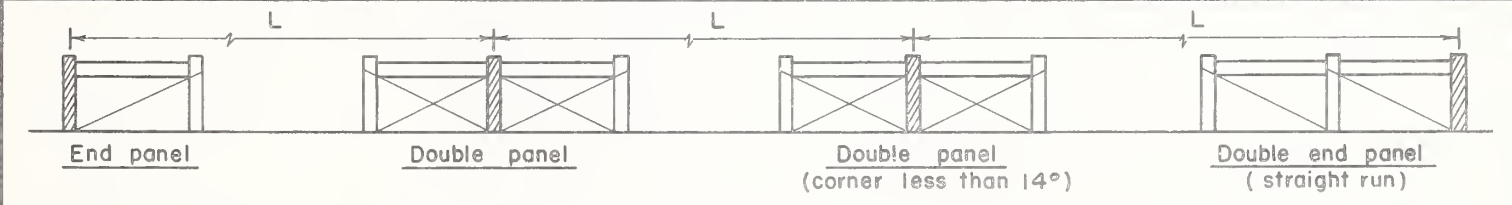


PLAN OF FENCE
(local road under interstate)

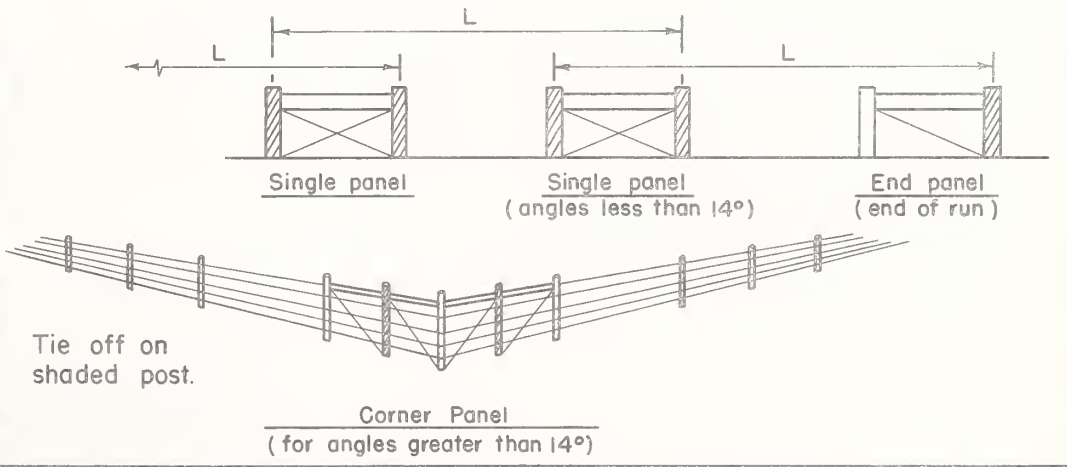


FENCE CONSTRUCTION ON SHARP VERTICAL CURVES

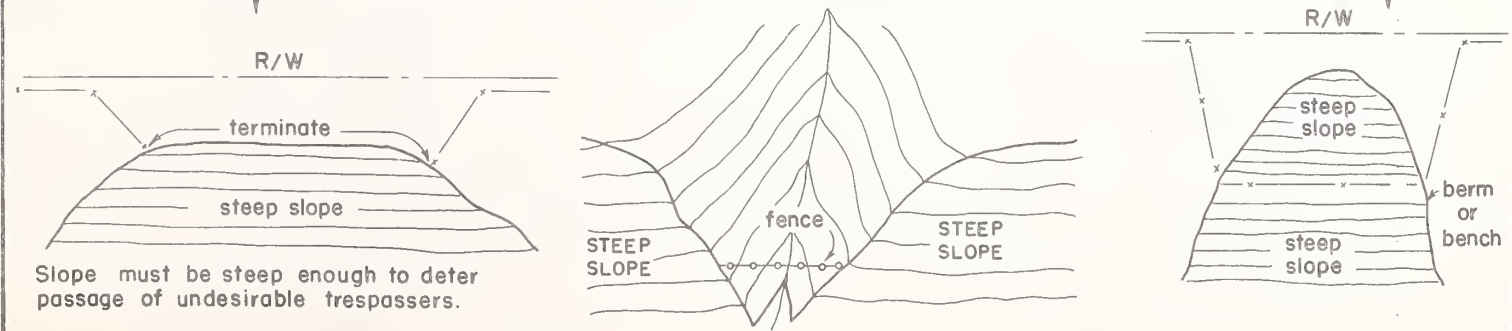
To avoid trying to conform woven wire to uneven terrain.



Fence type	run = L	panels required
Woven	33' or less	none
	33' - 330'	single or end
	over 330'	double
	max. 660'	
Barbed	66' or less	none
	66' - 660'	single or end
	over 660'	double
	max. 990'	



PERMISSIBLE FENCE LAYOUTS WHERE STEEP BACKSLOPES OR BANKS EXIST



REVISED 12-1-70
EFFECTIVE 1-1-71

STANDARD DRAWING NO. 81-03

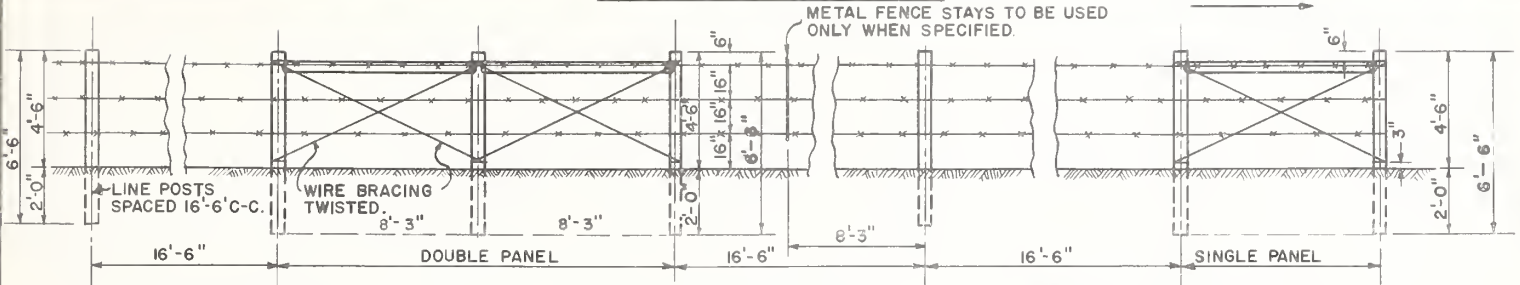
State Highway Commission
Helena, Montana

FARM FENCE

Approved

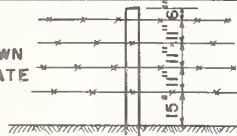
James H. Helms 10-24-68
State Highway Engineer

3 WIRE FENCE (TYPE F-3)



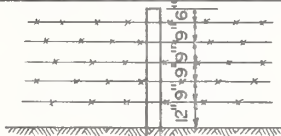
4 WIRE FENCE (TYPE F-4)

ALL WIRE
SPACING SHOWN
IS APPROXIMATE

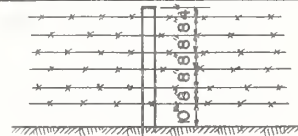


FOR PANEL DETAILS SEE
STD. DWG. 81-01

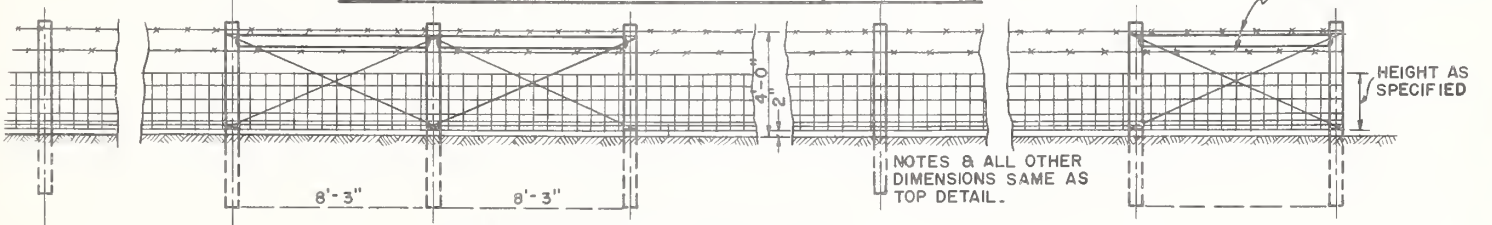
5 WIRE FENCE (TYPE F-5)



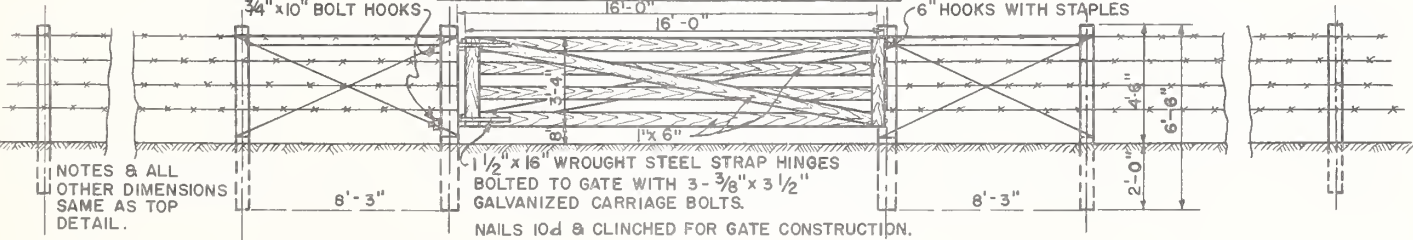
6 WIRE FENCE (TYPE F-6)



BARB WIRE & WOVEN WIRE FENCE (TYPE F-2)

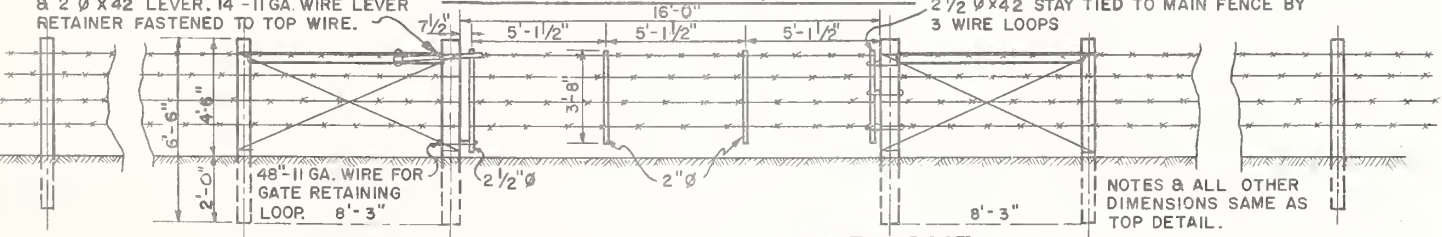


FARM ENTRANCE GATE (TYPE G-1)

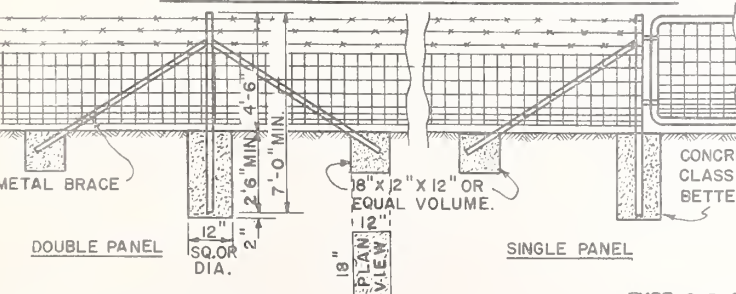


46" NO. 2 ELECTRICALLY WELDED TWIST
LINK CHAIN SECURELY STAPLED TO POST
& 2" Ø x 42" LEVER, 14" 11 GA. WIRE LEVER
RETAINER FASTENED TO TOP WIRE.

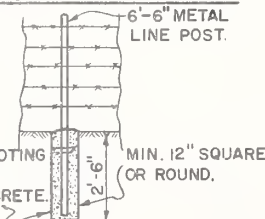
FARM ENTRANCE GATE (TYPE G-2)



STEEL POSTS & BRACES IN CONCRETE



METAL POST CONCRETE FOOTING



METAL LINE POSTS

6'-6" LONG, 1.33 LBS. PER FT.
NOMINAL FACTORY PAINTED OR
GALVANIZED.

CORNER, GATE & END POSTS

7'-0" LONG (NOMINAL)

TERMINAL POST

SHALL BE AT THE END OF ANY RUN OF
WIRE OR AT ANY STRETCH PANEL.

TYPE G-3 GATE
IS METAL.
A GOOD SUBSTANTIAL
GATE, COMMERCIALY
AVAILABLE AND IN
GENERAL USE.

NOTE:

A DEAD MAN MAY BE A CONCRETE BLOCK, A
CAST-IN-PLACE CONCRETE BLOCK, A ROCK
OR OTHER APPROVED OBJECT. WEIGHING AT
LEAST 150 LBS. AND COVERED AT LEAST 2 FEET

NOTE: (STEEL POSTS)

EACH CORNER, END GATE, OR PULL POST
AND EACH BRACE SHALL BE SET IN CONCRETE
AND BRACED AS INDICATED.

USE A 16' GATE UNLESS R/W AGREEMENT STATES
OTHERWISE.

ON TYPE G-2 FARM GATE, MATERIAL SHALL BE
THE SAME AS NEW FENCE.

REVISED 10-5-66 11-22-68 12-5-69
EFFECTIVE 2-1-67 1-1-69 1-1-70

STANDARD DRAWING NO. 82-01

State Highway Commission
Helena, Montana

CATTLE GUARD

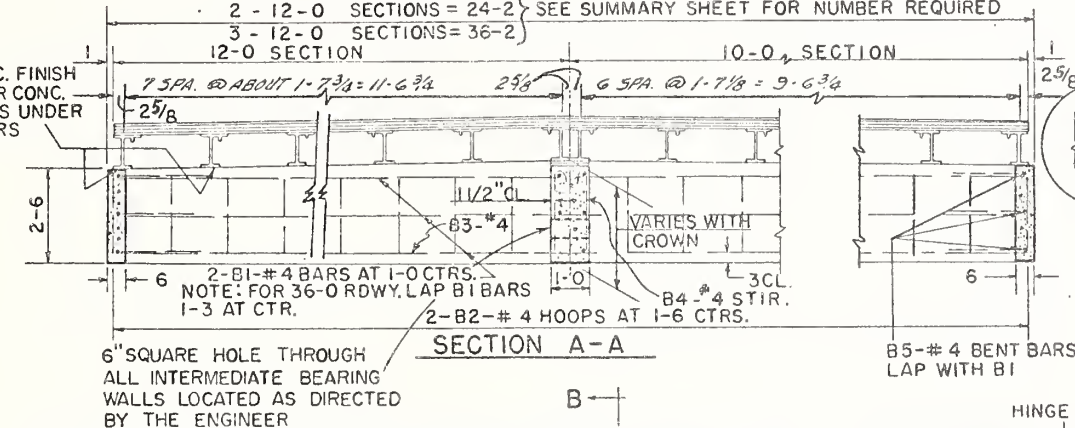
Approved

State Highway Engineer

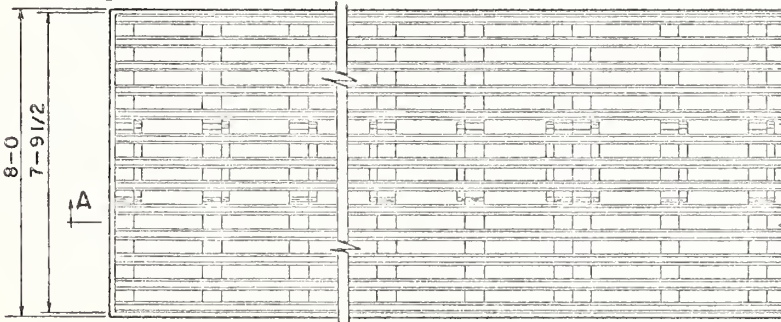
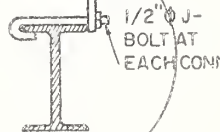
LIVE LOADING: STANDARD (H20) LOADING

3 - 10-0 SECTIONS = 30-2
2 - 10-0 SECTIONS = 20-2
2 - 12-0 SECTIONS = 24-2
3 - 12-0 SECTIONS = 36-2
SEE SUMMARY SHEET FOR NUMBER REQUIRED

SEE CONC. FINISH
NOTE FOR CONC.
SURFACES UNDER
STRINGERS



1-1/2" ϕ X 6" LAG SCREW
1/4" CONNECTION PLATE WELD TO
2X1 1/2 ANGLES WITH 3/16 FILLET
WELD ALL AROUND.



NOTE: THIS DIMENSION WILL VARY.
SEE APPROVED DWG. FOR
PROJECT BEFORE SETTING
ANY FOOTING GRADES.

PLAN

(FOR 7 GA., "T" = .1793")

7 GA. COLD FORMED
HIGH STRENGTH
STEEL. (SEE NOTES)

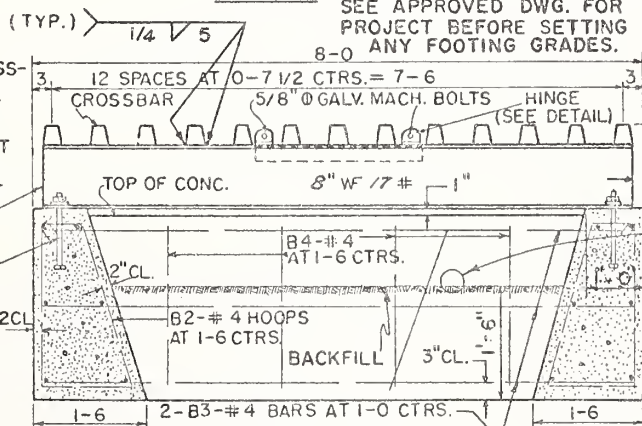
NOTE: EXTEND END CROSS-
BAR PLATE TO
BOTTOM OF 8" WF
STRINGER WITH
1-4 OF 1/8" FILLET
WELD SYMMET-
RICALLY DISTRIBUTED
TO FLANGE
AND WEB OF
STRINGER

CROSSBAR

NOTE:
SEE APPROVED
SHOP DWGS.
FOR ACTUAL
LOCATION OF
ANCHOR BOLTS.

3/4" ϕ ANCHOR BOLTS
EMBEDDED 9" IN CONC.
FOUR BOLTS REQ'D 2 1/2 CL.
EACH END OF
EACH SECTION SPACED
AT EQUAL INTERVALS

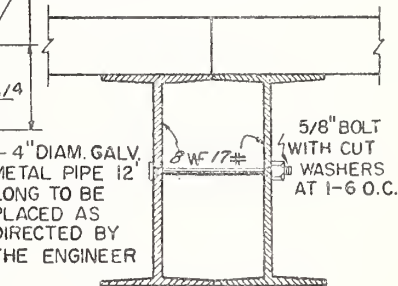
MAX. FOOTING PRESS. =
1.1 TONS/SQ. FT.



SECTION B-B

SEE ROAD PLANS FOR FINISHED GRADE
& CROWN OF ADJ. ROAD SECTIONS.

VARIES

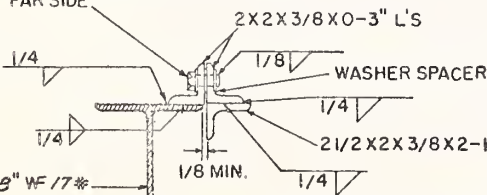


MULTIPLE INSTALLATION JOINT

EST. CLASS "A" CONC. QUANTITIES

24-0 RDWY. = 7 CU. YDS.
36-0 RDWY. = 11 CU. YDS.
20-0 RDWY. = 6 CU. YDS.
30-0 RDWY. = 9 CU. YDS.

5/8" ϕ BOLT WITH CUT WASHERS
EACH SIDE OF ANGLES. WELD
SHANK TO WASHER ALL AROUND
FAR SIDE



HINGE DETAIL

NOTE: LOCK DETAIL SIMILAR EXCEPT
USE 5/8" ϕ GALV. MACH. BOLT
WITH GALV. CUT WASHER & GALV.
HEX. NUTS INSTEAD OF WELDED
STUD BOLT.

3D (#2 TO #7) = INSIDE
4D (#8 TO #11) RADIUS

4D OR 2 1/2 MIN.

2 1/2 D = INSIDE RADIUS
(#2 TO #9 BARS)

D = DIA. OF BAR

BILL OF REINFORCING STEEL

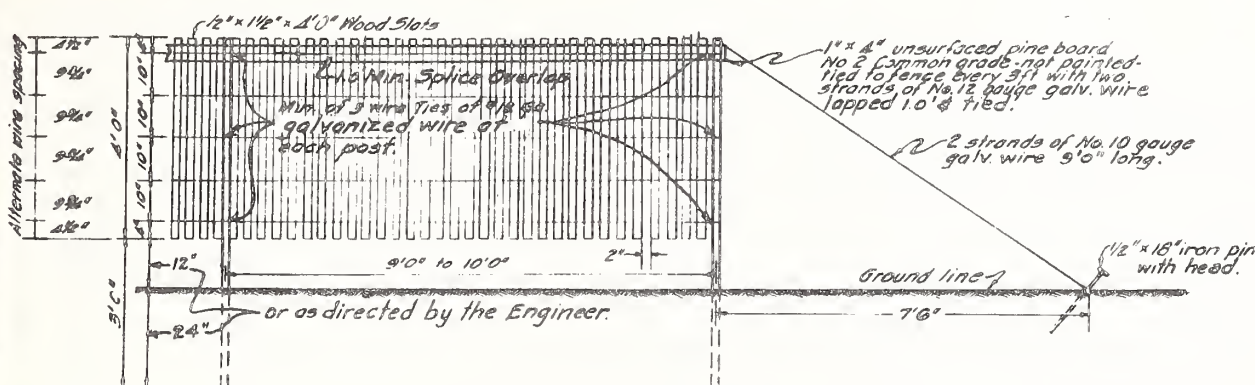
20' RDWY.						30' RDWY.						24' RDWY.						36' RDWY.					
MK.	SIZE	NO.	TYPE	LENGTH		MK.	SIZE	NO.	TYPE	LENGTH		MK.	SIZE	NO.	TYPE	LENGTH		MK.	SIZE	NO.	TYPE	LENGTH	
B1	4	12	STR.	19-10		B1	4	12	STR.	29-10		B1	4	12	STR.	23-10		B1	4	24	STR.	18-7	
B2	4	28	1	6-6		B2	4	42	1	6-6		B2	4	34	1	6-6		B2	4	50	1	6-6	
B3	4	6	STR.	7-7		B3	4	12	STR.	7-7		B3	4	6	STR.	7-7		B3	4	12	STR.	7-7	
B4	4	4	2	5-11		B4	4	8	2	5-11		B4	4	4	2	5-11		B4	4	8	2	5-11	
B5	4	6	3	10-7		B5	4	6	3	10-7		B5	4	6	3	10-7		B5	4	6	3	10-7	
EST. WT. = 369 LBS.						EST. WT. = 556 LBS.						EST. WT. = 427 LBS.						EST. WT. = 650 LBS.					

STANDARD DRAWING NO. 83-01

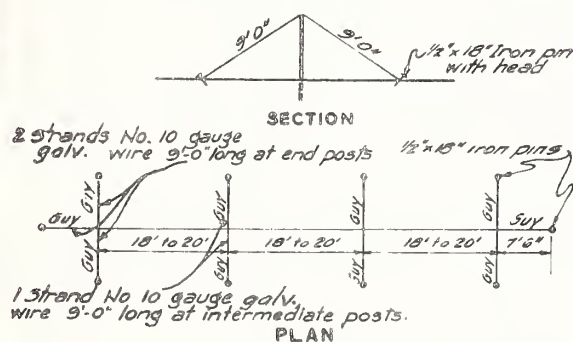
WOOD-SLAT SNOW FENCE

Approved By

State Highway Engineer



SINGLE HEIGHT SNOW FENCE



SEE STANDARD SPECIFICATIONS FOR WOOD SLAT
SNOW FENCE

POSTS: 7'0" LONG AND FURNISHED WITHOUT ANCHOR. POSTS SHALL BE GIVEN AT LEAST ONE COAT OF APPROVED PAINT. THE SECTION FORM OF POSTS MAY BE TUBULAR, TEE, EQUAL ANGLE, TEE RAIL OR MODIFIED CHANNEL PROVIDED THAT ALL POSTS WEIGH AT LEAST 1.33 POUNDS PER LINEAL FOOT.

WOOD SLATS: 1/2" X 1 1/2" X 4' WOVEN TOGETHER WITH 5 CABLES, EACH CONSISTING OF 2 GALVANIZED WIRES NOT SMALLER THAN 12 1/2 GAGE. SLATS TO BE PLACED 2" APART. EACH CABLE TO HAVE 2 COMPLETE TURNS IN THE WEAVE IN EACH SPACE BETWEEN SLATS. ALL SLATS TO BE TREATED WITH A HOT SOLUTION OF RED OXIDE OF IRON AS APPROVED BY THE ENGINEER.

LUMBER: ALL LUMBER SHALL BE UNTREATED EXCEPT 3" ROUND X 14' POSTS WHICH SHALL BE TREATED AS CALLED FOR IN THE STANDARD SPECIFICATIONS. ALL HOLES SHALL BE BORED BEFORE TREATMENT. LUMBER SHALL BE PACIFIC COAST DOUGLAS FIR OR AN APPROVED EQUAL AND SHALL BE EQUAL TO THE GRADE DEFINED AS SELECT COMMON IN ACCORDANCE WITH AMERICAN LUMBER STANDARDS FOR SOFT WOOD LUMBER.

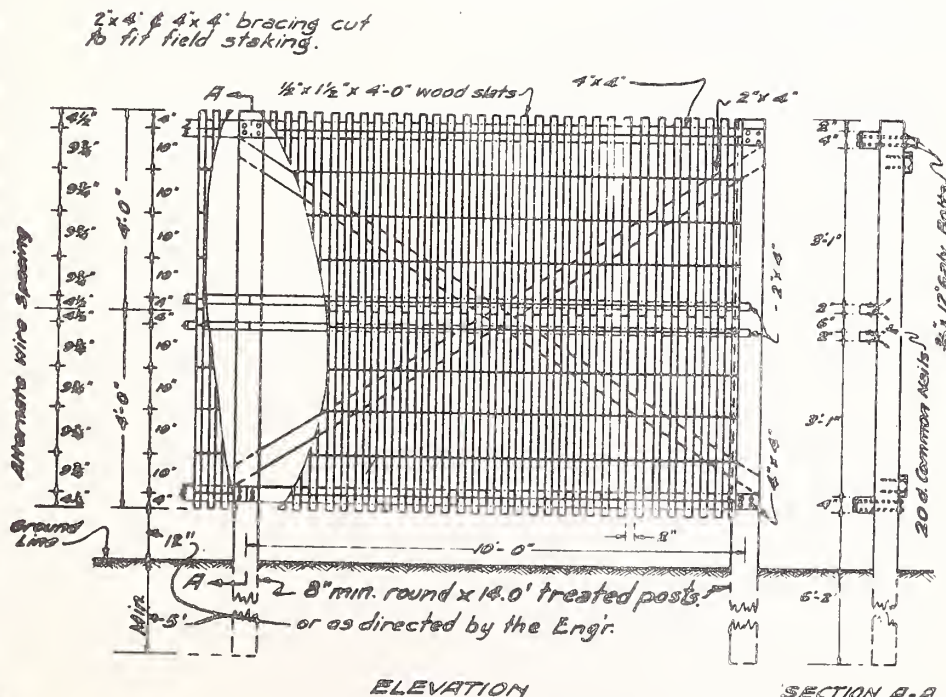
BOLTS: 4" X 4" STRINGERS TO BE BOLTED TO POSTS WITH 3/8" GALVANIZED BOLTS USING 1 1/2" DIAM. GALVANIZED WASHERS BETWEEN ALL BOLT HEADS AND NUTS AND THE WOOD.

STAPLES: WOOD SLAT SNOW FENCE TO BE STAPLED TO STRINGERS WITH 1 1/2" GALVANIZED STAPLES USING 21 STAPLES PER ROW PER 10' SECTION.

BRACES: 2" X 4" BRACES TO BE USED AT EACH END SECTION, AND AT 100' INTERVALS WHERE LENGTH OF FENCE PERMITS.

NAILS: 2" X 4" STRINGERS AND BRACES TO BE NAILED OR TOE-NAILED TO POSTS WITH 20D. COMMON NAILS. GALVANIZED.

TAMPING: BACKFILL AROUND POSTS SHALL BE THOROUGHLY TAMPED AND COMPACTED. WATERING SHALL BE RESORTED TO FOR THOROUGH COMPACTION IF REQUIRED BY THE ENGINEER.



ELEVATION

SECTION A-A

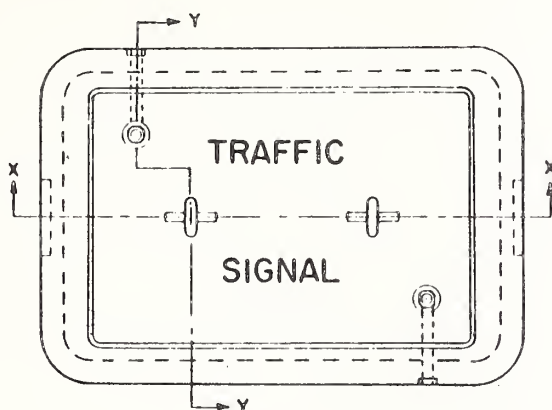
DOUBLE HEIGHT SNOW FENCE

State Highway Commission
Helena, Montana

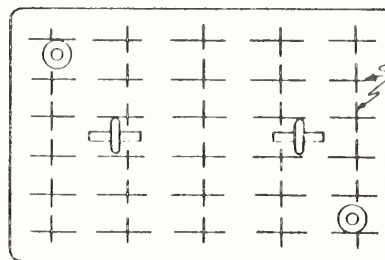
TYPE I PULL BOX DETAILS

Approved

Lewis M. Sullivan 11-22-68
State Highway Engineer



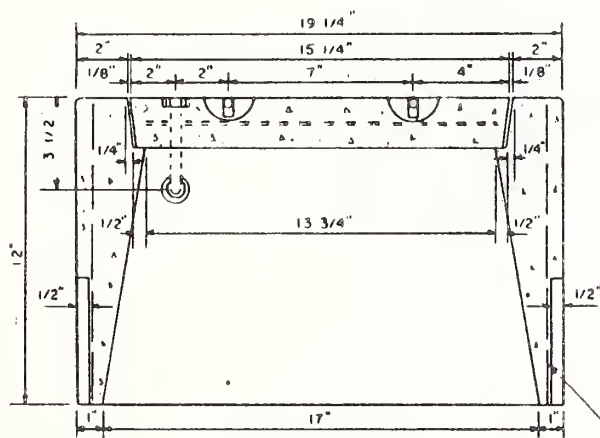
PLAN



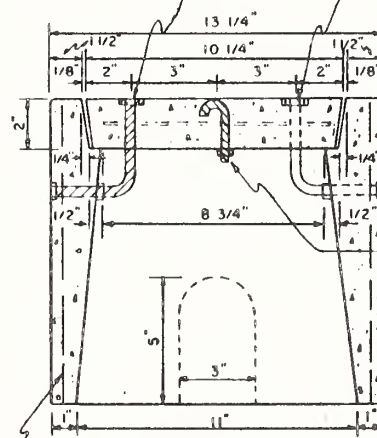
✓ No. 8 crimped high carbon
steel wire spaced as shown
6 one way, 3 the other way.

COVER REINFORCING PLAN

3/8" Brass hold down bolt with hexagonal brass nuts
Cover to be recessed to thickness of hold-down nut.
Bolt end not to extend above level of cover. Recess 1" dia

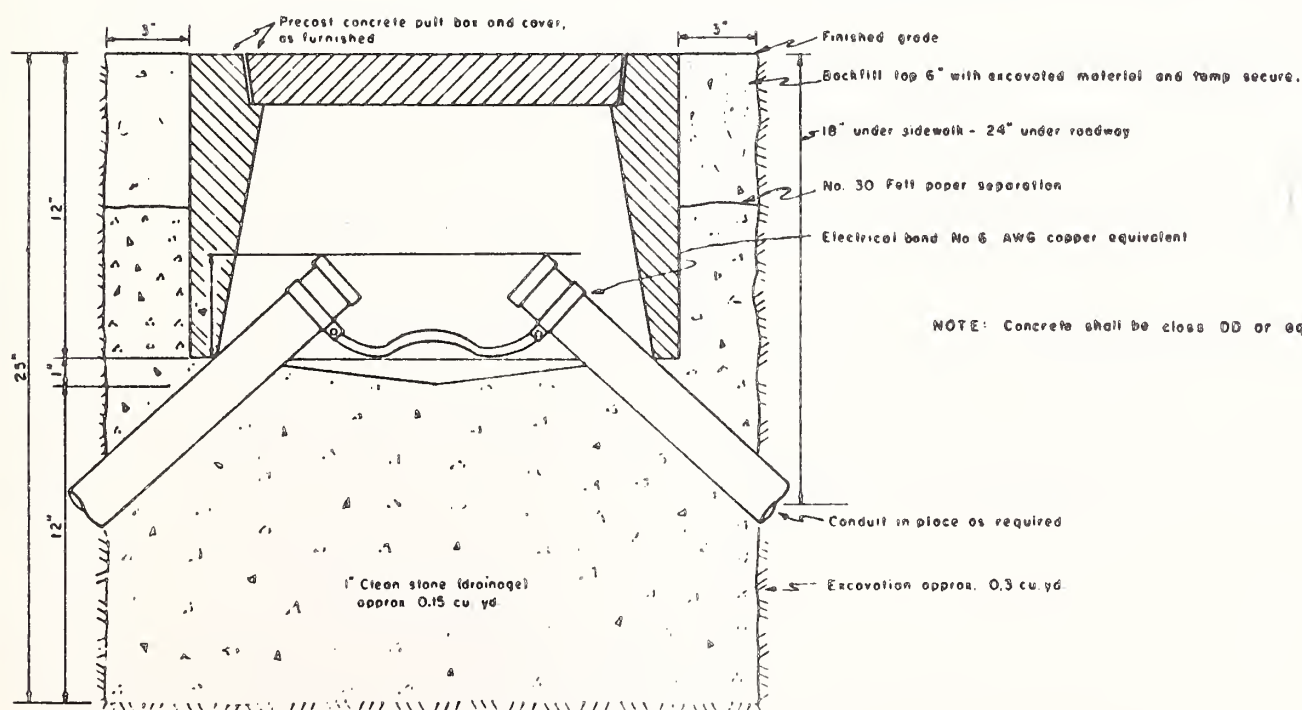


SECTION X-X



SECTION Y-Y

Reinforced cage No. 16 Galv. 3/4" mesh cut out of ends for conduit knockouts with spacing tabs turned in and out as necessary to position cage while pouring.



NOTE: Concrete shall be class DD or equal

INSTALLATION DETAIL

REVISED 11-1-68
EFFECTIVE 1-1-69

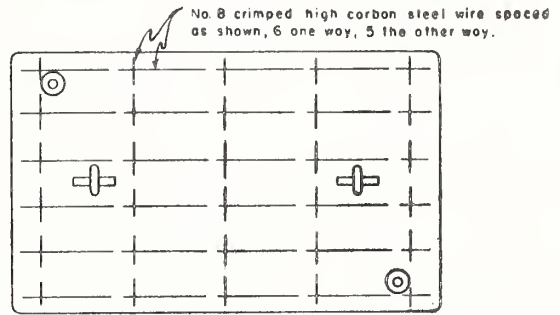
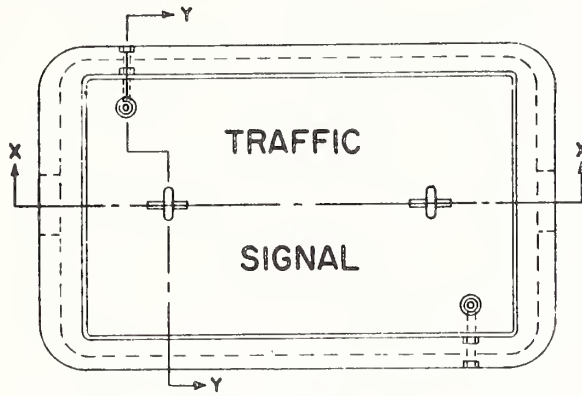
STANDARD DRAWING NO. 85-02

State Highway Commission
Helena, Montana

TYPE II PULL BOX DETAILS

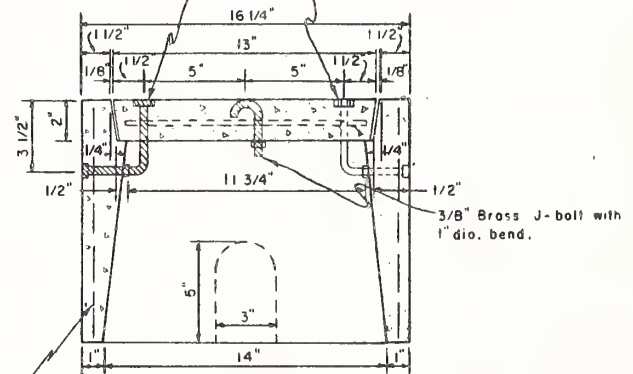
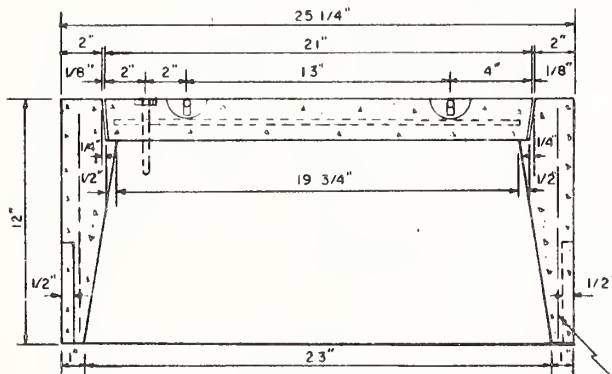
Approved

Lewis J. Phillips 11-22-68
State Highway Engineer

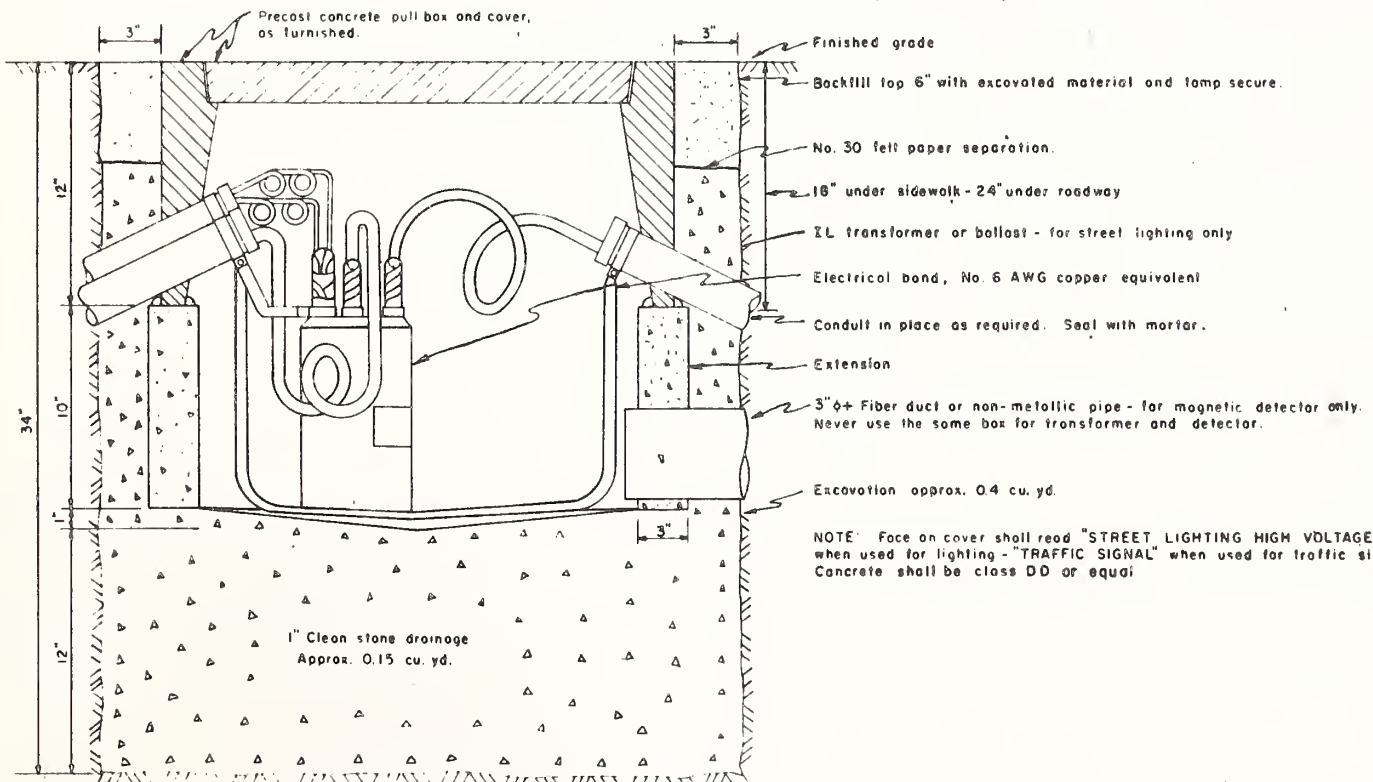


COVER REINFORCING PLAN

3/8" Brass hold down bolt with hexagonal brass nuts, Cover to be recessed to thickness of hold-down nut. Bolt end not to extend above level of cover. Recess 1" dia.



Reinforced cage No. 16 galv. 3/4" mesh cut out of ends for conduit knockouts with spacing tabs turned in and out as necessary to position cage while pouring.



INSTALLATION DETAILS

NOTE: Face on cover shall read "STREET LIGHTING HIGH VOLTAGE" when used for lighting - "TRAFFIC SIGNAL" when used for traffic signals. Concrete shall be class DD or equal.

REVISED 2-16-62 11-22-68
EFFECTIVE 2-16-62 1-1-69

STANDARD DRAWING NO. 87-01

STATE HIGHWAY
COMMISSION
HELENA, MONTANA

TRAFFIC SIGNAL AND HIGHWAY LIGHTING SYMBOLS

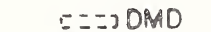
APPROVED
James H. Chittum 11-22-68
STATE HIGHWAY ENGINEER

PROPOSED

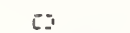
EXISTING



Signal conduit



Lighting conduit



Pull box



Directional magnetic detector



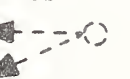
Non-directional pressure detector



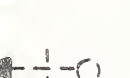
Non-directional magnetic detector



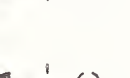
Directional pressure detector



Controller



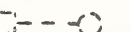
Traffic signal, each arrow one-way three-color
(on Type I standard unless otherwise specified)



Traffic signal one way three-color with backplate
(on Type I standard unless otherwise specified)



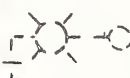
Traffic signal one way three-color with green arrow
(on Type I standard unless otherwise specified)
(Red and yellow louvered)



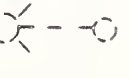
Walk - Don't Walk pedestrian signal
(Type I standard unless otherwise specified)



Mast arm traffic signal (with backplate) (on Type II standard)



Electrolier mast arm type with mast arm traffic signal (Type III standard)



Electrolier, mast arm type (Type X standard)



Pedestrian push button



Power pole



Telephone pole



Guard posts



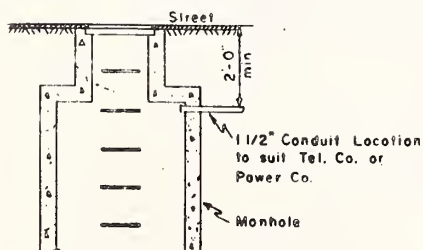
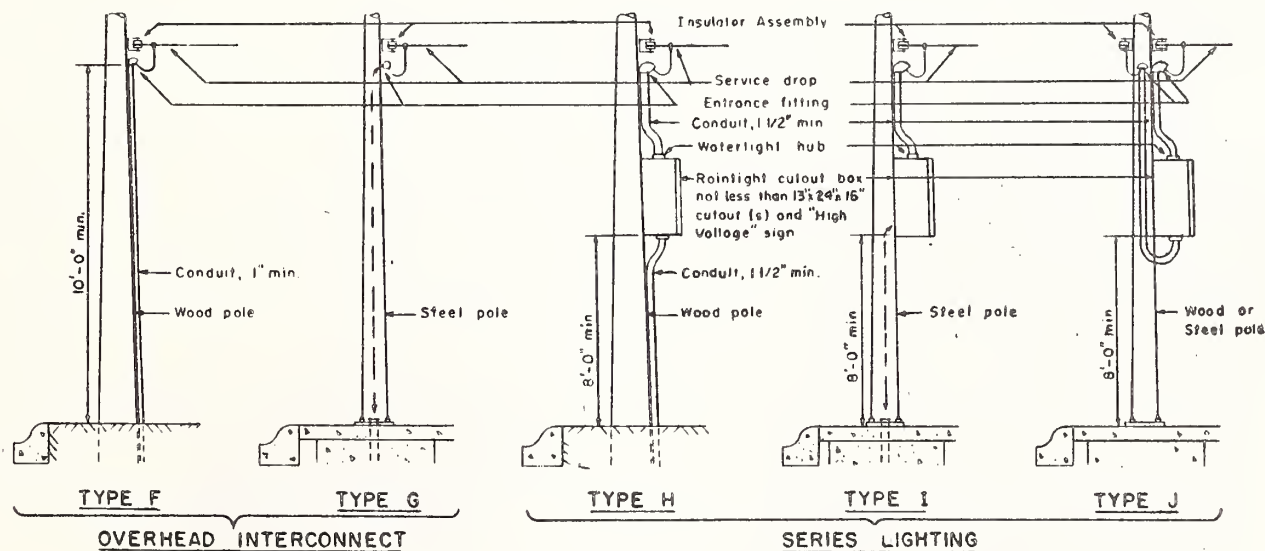
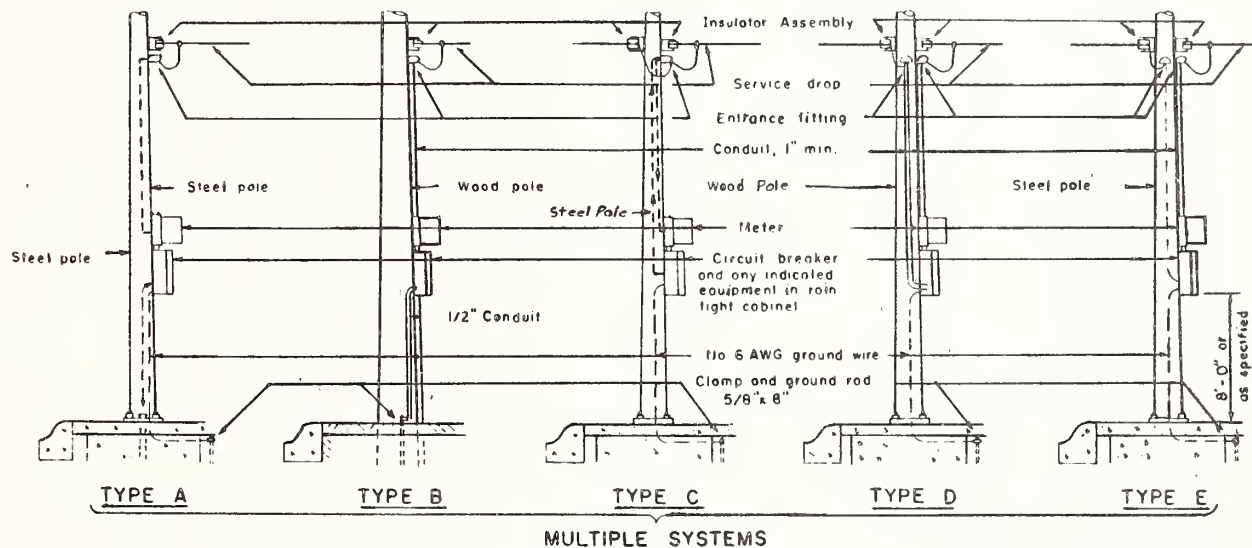
Guy and anchor assembly

State Highway Commission
Helena, Montana

ELECTRICAL SERVICE DETAILS

Approved

Lewis M. Chittings 11-22-68
State Highway Engineer



UNDERGROUND SERVICE

NOTE: Multiple systems shall be grounded adjacent to service pole as indicated. Ground wire shall be protected by means of conduit or hardwood moulding when run outside the pole.

REVISED 2-1-59 11-22-68
EFFECTIVE 2-1-59 1-1-69

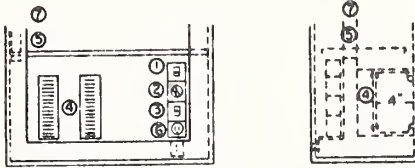
STANDARD DRAWING NO. 87-03

STATE HIGHWAY
COMMISSION
HELENA, MONTANA

CONTROLLER CABINET DETAILS AND PEDESTALS

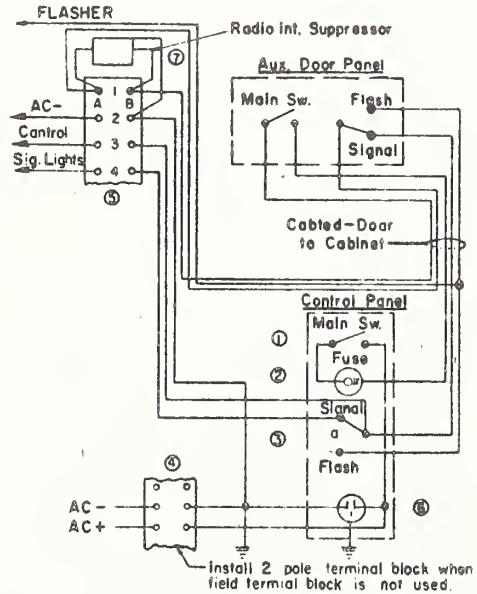
APPROVED

Leona M. Sullivan 11-22-68
STATE HIGHWAY ENGINEER



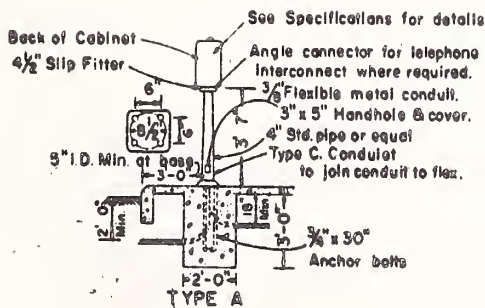
LOCATION OF TERMINAL BLOCKS
AND CONTROL PANEL

- ① Main Switch
- ② Plug Fuse Receptacle
- ③ Controller-Flash-Signal Switch
- ④ Field Wire Terminal Blocks
- ⑤ Instrument Terminal Block
- ⑥ NEMA Standard Grounding Outlet 15 Amp
- ⑦ Radio Interference Suppressor

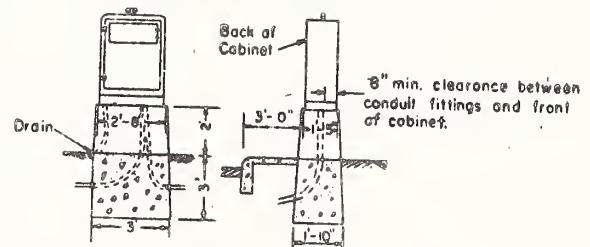


CABINET WIRING

DETAILS FOR TRAFFIC ACTUATED CONTROLLER CABINETS



TYPE A



TYPE D

CONTROLLER CABINET PEDESTALS

Note: If telephone line interconnection is specified controller cabinets shall have 5 inches of vertical clear space inside beneath all other equipment.

Painting: Controller cabinets shall be given one coat of aluminum paint inside and two coats of aluminum paint outside.

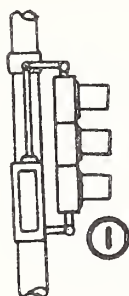
REVISED 8-7-61 11-22-68
EFFECTIVE 8-7-61 1-1-69

STANDARD DRAWING NO. 87-05

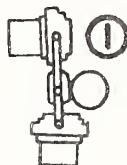
STATE HIGHWAY
COMMISSION
HELENA, MONTANA

VEHICULAR SIGNAL MOUNTINGS

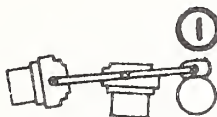
APPROVED
Lewis M. Coltrin 11-28-68
STATE HIGHWAY ENGINEER



B-1



B-2



B-3*



B-4



B-5*

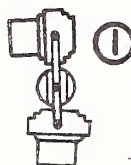
MOUNTING ON TYPE II, III, & X STANDARDS



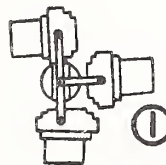
A-1



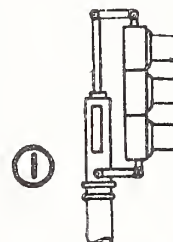
A-2*



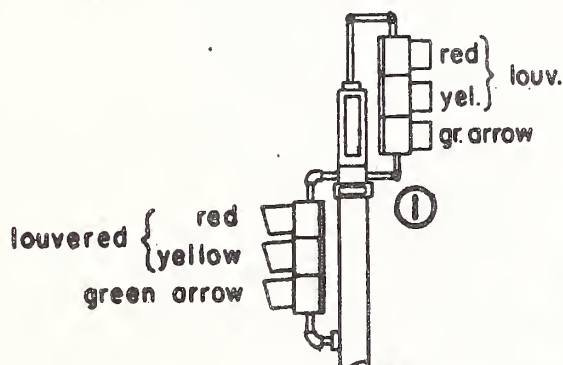
A-3



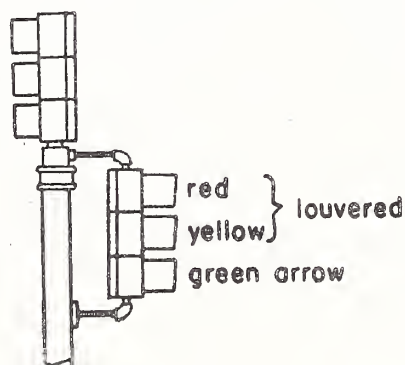
A-4



A-5*



A-6*



A-7

MOUNTING ON TYPE I STANDARDS

NOTE: ① Mounting includes terminal compartments.

* Special mountings to be used only when indicated on plans.

REFERENCE: STD. DWG. NO. 87-04 - SIGNAL HEAD DETAILS

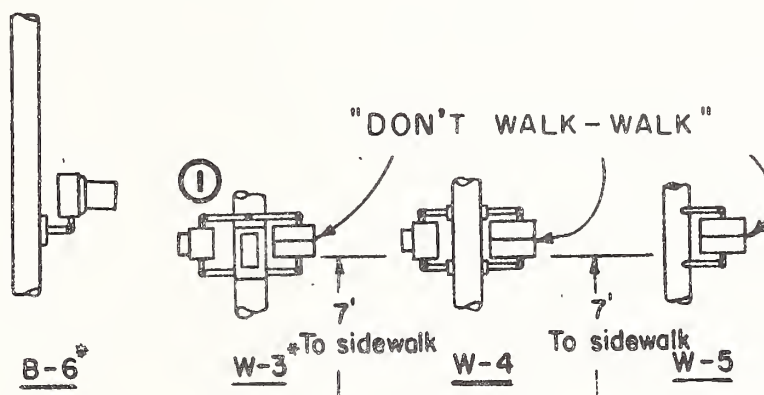
REVISED 8-7-61 11-22-68
EFFECTIVE 8-7-61 1-1-69

STANDARD DRAWING NO. 87-06

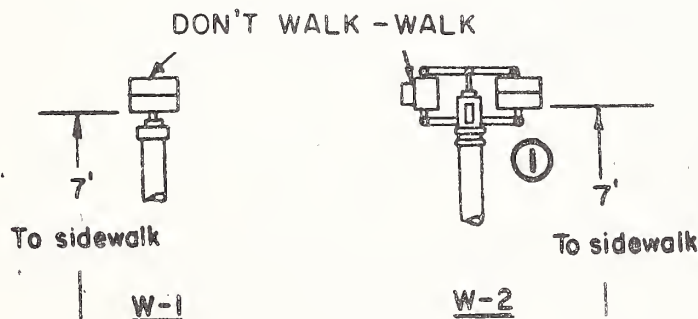
STATE HIGHWAY
COMMISSION
HELENA, MONTANA

PEDESTRIAN SIGNAL MOUNTINGS

APPROVED
Louis H. Phillips 11-22-68
STATE HIGHWAY ENGINEER



MOUNTING ON TYPE I, II, III, & X STANDARDS



MOUNTING ON TYPE I STANDARDS

NOTE: ① Mounting includes terminal compartments.

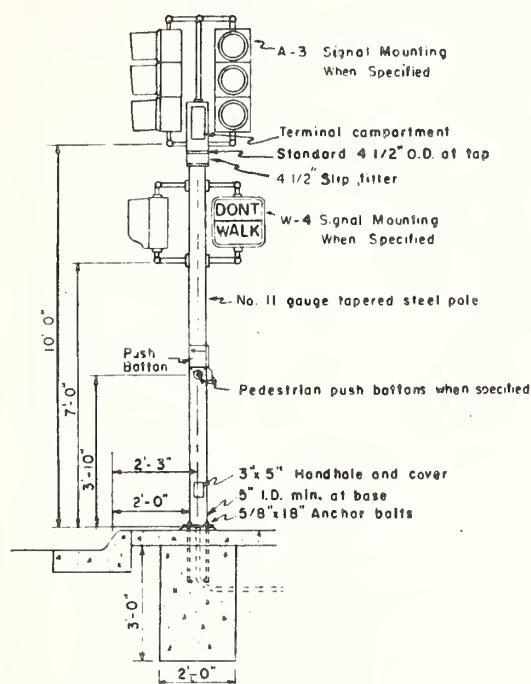
REFERENCE: STD. DWG. NO. 87-04 - SIGNAL HEAD DETAILS

State Highway Commission
Helena, Montana

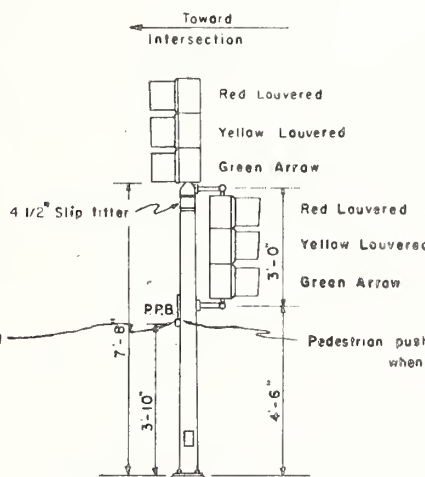
TYPE I STANDARD AND TYPICAL EQUIPMENT MOUNTINGS

Approved

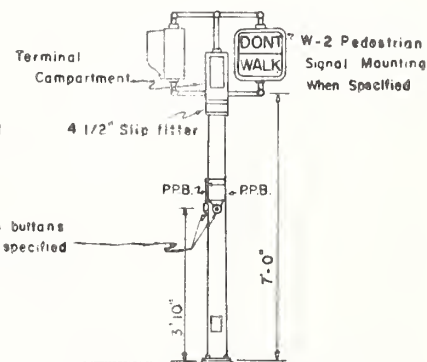
Lewis W. Chubb 11-22-68
State Highway Engineer



TYPE I STANDARD WITH
A-3 AND W-4 SIGNAL MOUNTING



TYPE I STANDARD
WITH A-7 SIGNAL MOUNTING
FOR LEFT TURN LANE SIGNALS

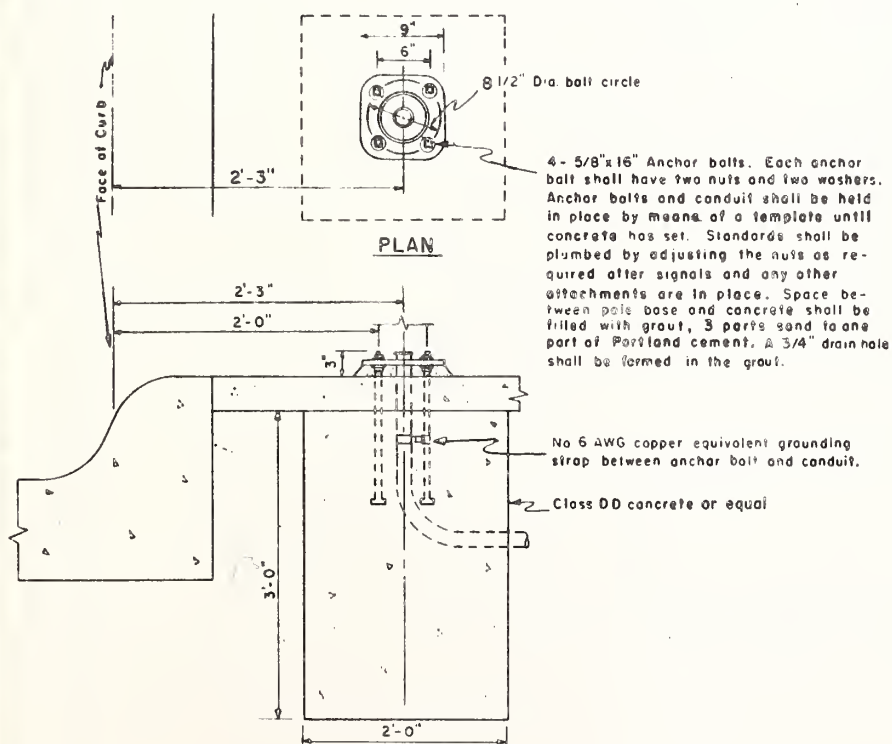


TYPE I STANDARD
WITH W-2 SIGNAL MOUNTING
FOR PEDESTRIANS

PAINTING. The Type I Standard shall receive two coats of signal post yellow of a shade approved by the Engineer. See Specifications.

NOTES: All shafts, bolts, screws, nuts, and washers shall be galvanized or cadmium plated.

See Plans and Standard Drawing Nos. 87-05 and 87-06 for type of
strong mountings.



SECTION A-A
TYPE I STANDARD FOUNDATION

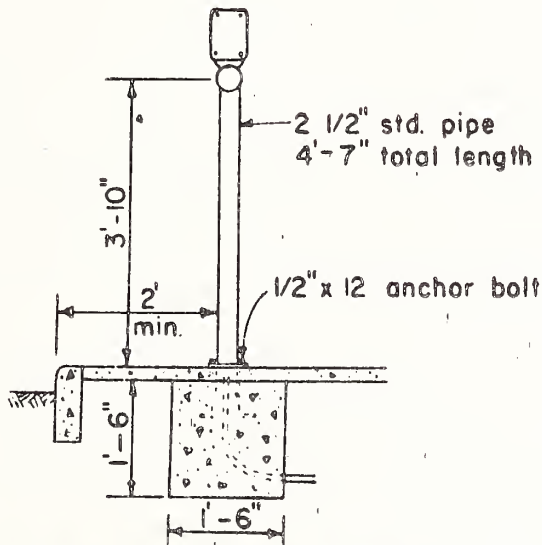
REVISED 2-1-59 11-22-68
EFFECTIVE 2-1-59 1-1-69

STANDARD DRAWING NO. 87-09

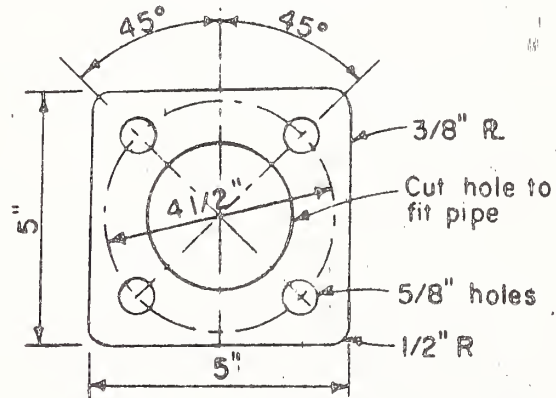
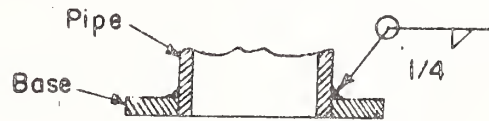
STATE HIGHWAY
COMMISSION
HELENA, MONTANA

PEDESTRIAN PUSH BUTTON DETAILS

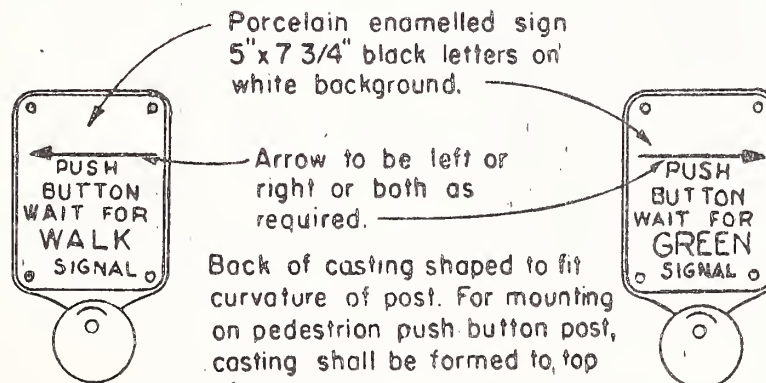
APPROVED
Levinson 11-22-68
STATE HIGHWAY ENGINEER



PEDESTRIAN PUSH
BUTTON POST



BASE DETAIL



FOR DON'T WALK - WALK
SIGNAL

FOR COLOR SIGNAL

PEDESTRIAN PUSH
BUTTON SIGN

Revised 5-1-63
Effective 5-1-63

Revised 11-22-68
Effective 1-1-69

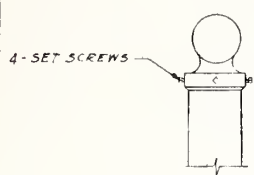
STANDARD DRAWING NO. 87-10

STATE HIGHWAY COMMISSION
HELENA, MONTANA

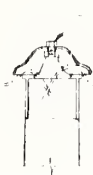
TYPE X STANDARD AND TYPICAL EQUIPMENT MOUNTINGS

APPROVED

James H. Sullivan 11-22-68
STATE HIGHWAY ENGINEER



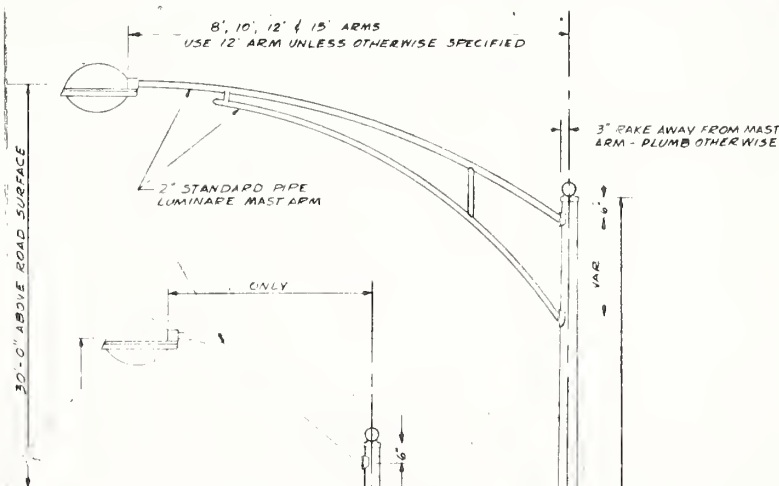
CAST IRON
POLE TOP



PRESSED STEEL
POLE TOP

REMOVABLE RAINLIGHT
POLE TOPS

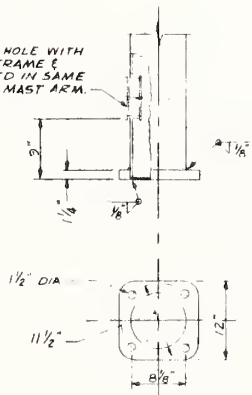
3/8" HEX HD. CAP SCREW
STEEL ADAPTER WELDED
TO POLE TOP



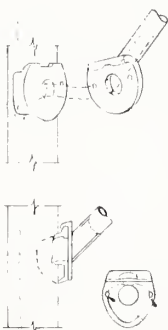
POLE SPECIFICATIONS

STEEL SHAFT SHALL BE MADE FROM ONE LENGTH OF BEST GRADE, HOT-ROLLED, BASIC OPEN HEARTH STEEL SHEET OF NOT LESS THAN #11 MANUFACTURER'S STANDARD GAUGE, HAVING ONE LONGITUDINAL, AUTOMATICALLY, ELECTRICALLY WELDED JOINT & NO INTERMEDIATE HORIZONTAL JOINTS OR WELDS. IT SHALL BE FORMED INTO A CONTINUOUSLY TAPERED SHAFT HAVING A TAPER OF APPROXIMATELY 1/8" PER FOOT, WELDED & LONGITUDINALLY COLD-ROLLED UNDER SUFFICIENT PRESSURE TO FLATTEN THE WELD & IMPROVE THE PHYSICAL CHARACTERISTICS OF THE METAL TO INSURE A YIELD STRENGTH IN EXCESS OF 48,000 PSI.

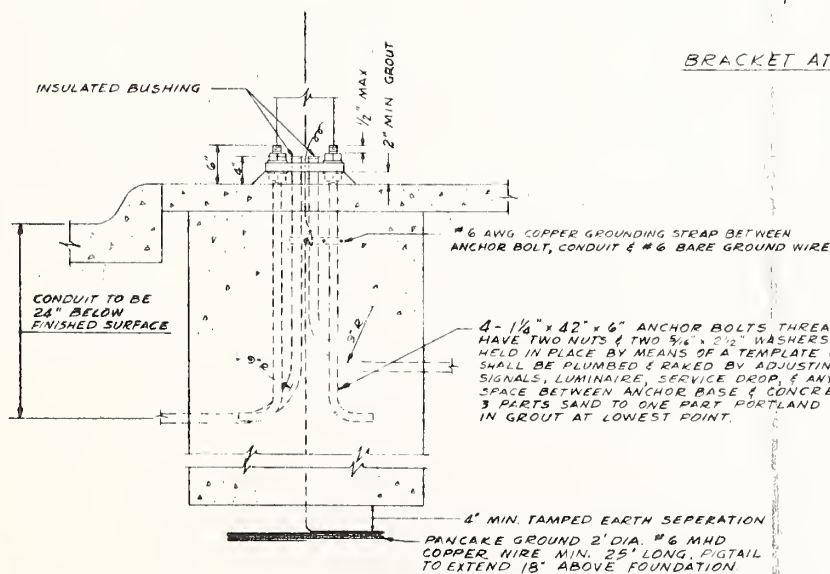
4" x 6 1/2" HAND HOLE WITH REINFORCED FRAME & COVER, LOCATED IN SAME QUADRANT AS MAST ARM.



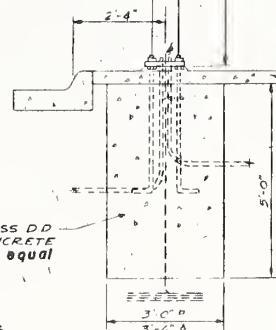
ANCHOR BASE



BRACKET ATTACHMENT



DETAIL



ELEVATION

NOTES-

ALL SHAFTS, MAST ARMS, BOLTS, NUTS, WASHERS & ANCHOR BASE SHALL BE GALVANIZED OR CADMIUM PLATED.

DRAWN 10/3/67

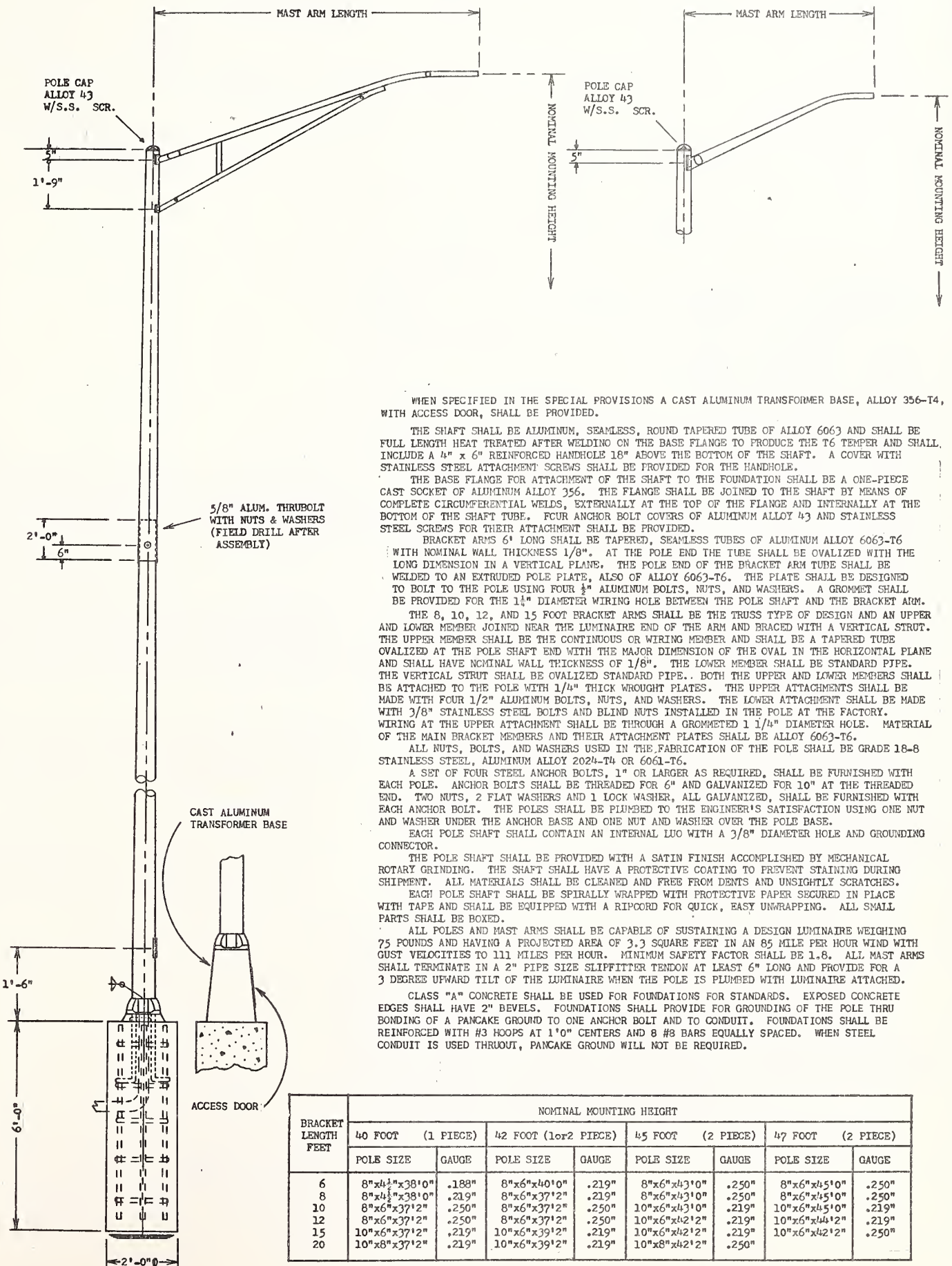
REVISED 11-1-68
EFFECTIVE 1-1-69

STANDARD DRAWING NO. 87-10A

STATE HIGHWAY COMMISSION
HELENA, MONTANA

STANDARD ALUMINUM TYPE 10-A

APPROVED

Lewis H. Chittum 11-22-68
STATE HIGHWAY ENGINEER

WHEN SPECIFIED IN THE SPECIAL PROVISIONS A CAST ALUMINUM TRANSFORMER BASE, ALLOY 356-T4, WITH ACCESS DOOR, SHALL BE PROVIDED.

THE SHAFT SHALL BE ALUMINUM, SEAMLESS, ROUND TAPERED TUBE OF ALLOY 6063 AND SHALL BE FULL LENGTH HEAT TREATED AFTER WELDING ON THE BASE FLANGE TO PRODUCE THE T6 TEMPER AND SHALL INCLUDE A 4" x 6" REINFORCED HANDHOLE 18" ABOVE THE BOTTOM OF THE SHAFT. A COVER WITH STAINLESS STEEL ATTACHMENT SCREWS SHALL BE PROVIDED FOR THE HANDHOLE.

THE BASE FLANGE FOR ATTACHMENT OF THE SHAFT TO THE FOUNDATION SHALL BE A ONE-PIECE CAST SOCKET OF ALUMINUM ALLOY 356. THE FLANGE SHALL BE JOINED TO THE SHAFT BY MEANS OF COMPLETE CIRCUMFERENTIAL WELDS, EXTERNALLY AT THE TOP OF THE FLANGE AND INTERNALLY AT THE BOTTOM OF THE SHAFT TUBE. FOUR ANCHOR BOLT COVERS OF ALUMINUM ALLOY 43 AND STAINLESS STEEL SCREWS FOR THEIR ATTACHMENT SHALL BE PROVIDED.

BRACKET ARMS 6' LONG SHALL BE TAPERED, SEAMLESS TUBES OF ALUMINUM ALLOY 6063-T6 WITH NOMINAL WALL THICKNESS 1/8". AT THE POLE END THE TUBE SHALL BE OVALIZED WITH THE LONG DIMENSION IN A VERTICAL PLANE. THE POLE END OF THE BRACKET ARM TUBE SHALL BE WELDED TO AN EXTRUDED POLE PLATE, ALSO OF ALLOY 6063-T6. THE PLATE SHALL BE DESIGNED TO BOLT TO THE POLE USING FOUR 1/2" ALUMINUM BOLTS, NUTS, AND WASHERS. A GROMMET SHALL BE PROVIDED FOR THE 1 1/4" DIAMETER WIRING HOLE BETWEEN THE POLE SHAFT AND THE BRACKET ARM.

THE 8, 10, 12, AND 15 FOOT BRACKET ARMS SHALL BE THE TRUSS TYPE OF DESIGN AND AN UPPER AND LOWER MEMBER JOINED NEAR THE LUMINAIRE END OF THE ARM AND BRACED WITH A VERTICAL STRUT. THE UPPER MEMBER SHALL BE THE CONTINUOUS OR WIRING MEMBER AND SHALL BE A TAPERED TUBE OVALIZED AT THE POLE SHAFT END WITH THE MAJOR DIMENSION OF THE OVAL IN THE HORIZONTAL PLANE AND SHALL HAVE NOMINAL WALL THICKNESS OF 1/8". THE LOWER MEMBER SHALL BE STANDARD PIPE. THE VERTICAL STRUT SHALL BE OVALIZED STANDARD PIPE. BOTH THE UPPER AND LOWER MEMBERS SHALL BE ATTACHED TO THE POLE WITH 1/4" THICK WROUGHT PLATES. THE UPPER ATTACHMENTS SHALL BE MADE WITH FOUR 1/2" ALUMINUM BOLTS, NUTS, AND WASHERS. THE LOWER ATTACHMENT SHALL BE MADE WITH 3/8" STAINLESS STEEL BOLTS AND BLIND NUTS INSTALLED IN THE POLE AT THE FACTORY. WIRING AT THE UPPER ATTACHMENT SHALL BE THROUGH A GROMMETED 1 1/4" DIAMETER HOLE. MATERIAL OF THE MAIN BRACKET MEMBERS AND THEIR ATTACHMENT PLATES SHALL BE ALLOY 6063-T6.

ALL NUTS, BOLTS, AND WASHERS USED IN THE FABRICATION OF THE POLE SHALL BE GRADE 18-8 STAINLESS STEEL, ALUMINUM ALLOY 2024-T4 OR 6061-T6.

A SET OF FOUR STEEL ANCHOR BOLTS, 1" OR LARGER AS REQUIRED, SHALL BE FURNISHED WITH EACH POLE. ANCHOR BOLTS SHALL BE THREADED FOR 6" AND GALVANIZED FOR 10" AT THE THREADED END. TWO NUTS, 2 FLAT WASHERS AND 1 LOCK WASHER, ALL GALVANIZED, SHALL BE FURNISHED WITH EACH ANCHOR BOLT. THE POLES SHALL BE PLUMBED TO THE ENGINEER'S SATISFACTION USING ONE NUT AND WASHER UNDER THE ANCHOR BASE AND ONE NUT AND WASHER OVER THE POLE BASE.

EACH POLE SHAFT SHALL CONTAIN AN INTERNAL LUG WITH A 3/8" DIAMETER HOLE AND GROUNDING CONNECTOR.

THE POLE SHAFT SHALL BE PROVIDED WITH A SATIN FINISH ACCOMPLISHED BY MECHANICAL ROTARY GRINDING. THE SHAFT SHALL HAVE A PROTECTIVE COATING TO PREVENT STAINING DURING SHIPMENT. ALL MATERIALS SHALL BE CLEANED AND FREE FROM DENTS AND UNSIGHTLY SCRATCHES.

EACH POLE SHAFT SHALL BE SPIRALLY WRAPPED WITH PROTECTIVE PAPER SECURED IN PLACE WITH TAPE AND SHALL BE EQUIPPED WITH A ROPCORD FOR QUICK, EASY UNWRAPPING. ALL SMALL PARTS SHALL BE BOXED.

ALL POLES AND MAST ARMS SHALL BE CAPABLE OF SUSTAINING A DESIGN LUMINAIRE WEIGHING 75 POUNDS AND HAVING A PROJECTED AREA OF 3.3 SQUARE FEET IN AN 85 MILE PER HOUR WIND WITH GUST VELOCITIES TO 111 MILES PER HOUR. MINIMUM SAFETY FACTOR SHALL BE 1.8. ALL MAST ARMS SHALL TERMINATE IN A 2" PIPE SIZE SLIPFITTER TENDON AT LEAST 6" LONG AND PROVIDE FOR A 3 DEGREE UPWARD TILT OF THE LUMINAIRE WHEN THE POLE IS PLUMBED WITH LUMINAIRE ATTACHED.

CLASS "A" CONCRETE SHALL BE USED FOR FOUNDATIONS FOR STANDARDS. EXPOSED CONCRETE EDGES SHALL HAVE 2" BEVELS. FOUNDATIONS SHALL PROVIDE FOR GROUNDING OF THE POLE THRU BONDING OF A PANCAKE GROUND TO ONE ANCHOR BOLT AND TO CONDUIT. FOUNDATIONS SHALL BE REINFORCED WITH #3 HOOPS AT 1'0" CENTERS AND 8 #8 BARS EQUALLY SPACED. WHEN STEEL CONDUIT IS USED THRUOUT, PANCAKE GROUND WILL NOT BE REQUIRED.

BRACKET LENGTH FEET	NOMINAL MOUNTING HEIGHT							
	40 FOOT (1 PIECE)		42 FOOT (1 or 2 PIECE)		45 FOOT (2 PIECE)		47 FOOT (2 PIECE)	
	POLE SIZE	GAUGE	POLE SIZE	GAUGE	POLE SIZE	GAUGE	POLE SIZE	GAUGE
6	8"x4 1/2"x38'0"	.188"	8"x6"x40'0"	.219"	8"x6"x43'0"	.250"	8"x6"x45'0"	.250"
8	8"x4 1/2"x38'0"	.219"	8"x6"x37'2"	.219"	8"x6"x43'0"	.250"	8"x6"x45'0"	.250"
10	8"x6"x37'2"	.250"	8"x6"x37'2"	.250"	10"x6"x43'0"	.219"	10"x6"x45'0"	.219"
12	8"x6"x37'2"	.250"	8"x6"x37'2"	.250"	10"x6"x42'2"	.219"	10"x6"x44'2"	.219"
15	10"x6"x37'2"	.219"	10"x6"x39'2"	.219"	10"x6"x42'2"	.219"	10"x6"x42'2"	.250"
20	10"x8"x37'2"	.219"	10"x6"x39'2"	.219"	10"x8"x42'2"	.250"		

NOTE: USE SHAFT LENGTH AS INDICATED OR AS REQUIRED TO GIVE PROPER MOUNTING HEIGHT.

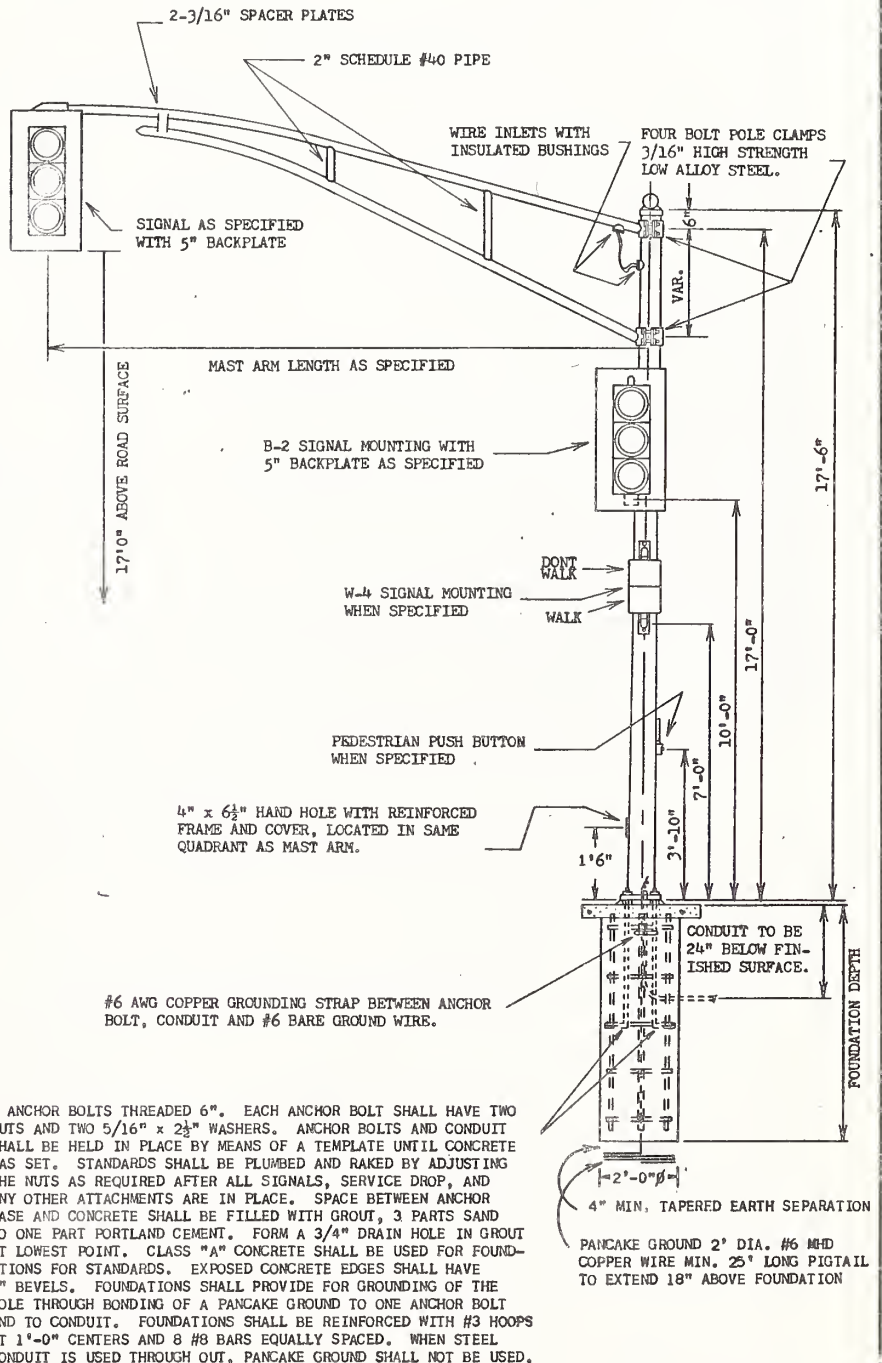
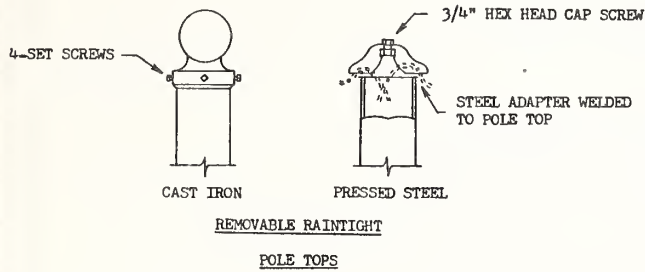
DRAWN 10/11/67

REVISED 11-1-68
EFFECTIVE 1-1-69

STANDARD DRAWING NO. 87-12

STATE HIGHWAY COMMISSION
HELENA, MONTANATYPE 2 STANDARD AND TYPICAL
EQUIPMENT MOUNTINGS

APPROVED

James R. Miller 11-22-68
STATE HIGHWAY ENGINEER

POLE SPECIFICATIONS

THE STEEL SHAFT SHALL BE MADE FROM ONE LENGTH OF THE BEST GRADE, HOT-ROLLED, BASIC OPEN HEARTH STEEL SHEET OF NOT LESS THAN #7 MANUFACTURERS STANDARD GAUGE, HAVING ONE LONGITUDINAL, AUTOMATICALLY, ELECTRICALLY WELDED JOINT AND NO INTERMEDIATE HORIZONTAL JOINTS NOR WELDS. THE SHAFT SHALL BE FORMED INTO A CONTINUOUS TAPER OF APPROXIMATELY .14" PER FOOT, WELDED AND LONGITUDINALLY COLD-ROLLED UNDER SUFFICIENT PRESSURE TO FLATTEN THE WELD AND IMPROVE THE PHYSICAL CHARACTERISTICS OF THE METAL TO INSURE A YIELD STRENGTH IN EXCESS OF 48,000 PSI.

SIGNAL MAST ARM ASSEMBLY SPECIFICATION

THE UPPER AND LOWER TAPERED MEMBERS SHALL BE MADE FROM NOT LESS THAN #11 MANUFACTURERS STANDARD GAUGE, BEST GRADE, HOT-ROLLED BASIC OPEN HEARTH STEEL. EACH MEMBER SHALL BE FORMED, WELDED AND LONGITUDINALLY COLD-ROLLED UNDER SUFFICIENT PRESSURE TO FLATTEN THE WELD, FORM A ROUND TUBE TAPERED APPROXIMATELY .07" PER FOOT AND IMPROVE THE PHYSICAL CHARACTERISTICS OF THE METAL TO INSURE A YIELD STRENGTH IN EXCESS OF 48,000 PSI. FINAL 4" OF UPPER MEMBER SHALL BE REDUCED TO 2" PIPE FOR SLIP FITTER MAST ARM MOUNTING OF SIGNAL.

DESIGN SPECIFICATIONS

POLES AND MAST ARMS SHALL BE CAPABLE OF SUSTAINING AT THE END OF THE MAST ARM SIGNALS HAVING A MAXIMUM WEIGHT OF 135 POUNDS AND A DESIGN WIND DRAG FORCE NOT EXCEEDING 90 POUNDS. MINIMUM SAFETY FACTOR SHALL BE 1.82 ON YIELD STRENGTH FOR WEIGHT LOAD AND BASIC WIND PRESSURE OF 23 PSF.

NOTES:

ALL SHAFTS, MAST ARMS, BOLTS, NUTS, WASHERS AND ANCHOR BASE SHALL BE GALVANIZED OR CADMIUM PLATED.

BOTTOM 10 FEET OF THE POLE SHALL RECEIVE TWO COATS OF SIGNAL POST YELLOW OF A SHADE APPROVED BY THE ENGINEER. (SEE SPECIFICATIONS)

SEE PLANS AND STANDARD DRAWING NO'S 87-04, 87-05 & 87-06 FOR TYPE OF SIGNAL MOUNTING.

TYPE 2 SIGNAL STANDARDS						
BRACKET LENGTH FEET	POLE		ANCHOR BOLT			FOUNDATION DIMENSIONS
	SIZE	GAUGE	SIZE	CIRCLE	PROTRUSION	
15, 20, & 25'	8.5"x6.0"x17'6"	7	1 1/4"x48"	11 1/2"	2 3/4"	2'0"0"x6'0"
30' & 35'	10.0"x7.8"x17'6"	7	1 1/4"x60"	13 1/2"	3 3/8"	2'0"0"x7'6"

REVISED 11-22-68
EFFECTIVE 1-1-69

STANDARD DRAWING NO 87-18

State Highway Commission
Helena, Montana

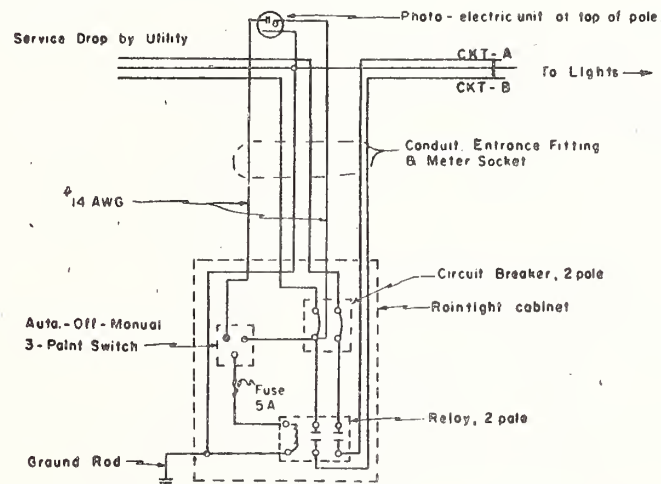
TYPICAL WIRING DIAGRAM OF SERVICE EQUIPMENT

Approved:
James M. Sullivan 11-22-68
State Highway Engineer

120/240 VOLT HIGHWAY LIGHTING INSTALLATION OVERHEAD CONDUCTOR

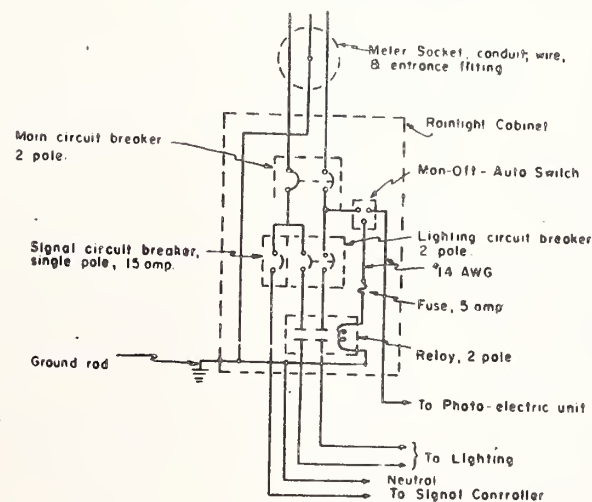
CB Size Amps	Relay Size Amps	Min. Wire Size AWG	Min. Conduit Size - Inch
30	30	8	1 1/4
50	50	6	1 1/2
70	100	4	1 1/2

NOTE: Minimum wire and conduit sizes shall apply unless indicated otherwise.



SIGNALS AND 120/240 VOLT HIGHWAY LIGHTING INSTALLATION

MAIN		LIGHTING		
CB Size Amps	Min Wire Size AWG	CB Size Amps	Relay Rating Amps	Wire Size AWG
30	8	20	30	8
50	6	30	30	6
70	4	50	50	6
100	2	70	100	4



DRAWN 10-18-67

REVISED 11-1-68
EFFECTIVE 1-1-69

STANDARD DRAWING NO. 87-21

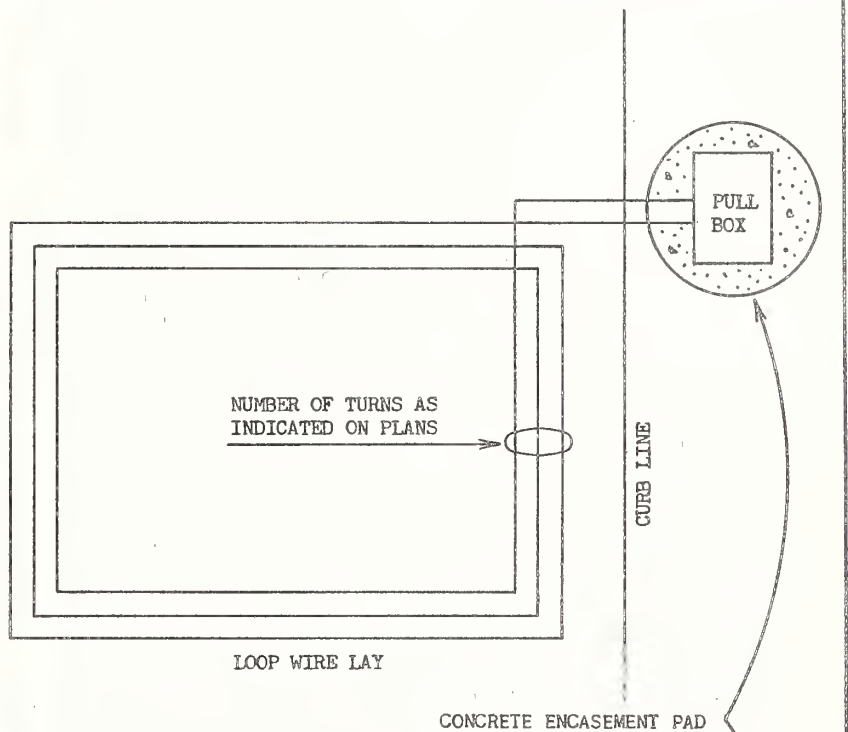
MONTANA HIGHWAY COMMISSION
HELENA, MONTANA

LOOP DETECTOR INSTALLATION DETAIL

APPROVED

James H. Phillips 11-22-68
STATE HIGHWAY ENGINEER

ROADWAY CENTER LINE

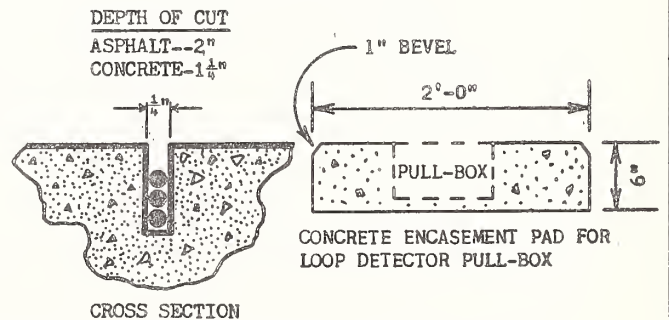
DIMENSION
AS
INDICATED
ON PLANSDIMENSION AS INDICATED
ON PLANSOVERLAP DIAGONAL CUTS SO THAT
SLOT IS FULL DEPTH AT TURN POINTS
OR MERELY CHIP SHARP INNER CORNERS.

THE LOOP WIRE SHALL BE #12 TYPE UF.

THE SLOT SHOULD BE BRUSHED OR BLOWN CLEAN OF ALL LOOSE MATERIALS. THE LOOP WIRE SHOULD BE CAREFULLY PUSHED INTO THE SLOT WITH A BLUNT STICK TO AVOID DAMAGING ITS INSULATION. AN ELASTIC EPOXY RESIN COMPOUND SHALL BE USED FOR SEALING THE SLOT AND ANCHORING THE WIRE LOOP SECURELY. RESISTANCE OF THE WIRE LOOP TO GROUND SHOULD BE CHECKED AFTER THE WIRE IS PLACED IN THE SLOT, BOTH BEFORE AND AFTER THE SLOT IS SEALED. A RESISTANCE OF LESS THAN 10 MEGOHMS INDICATES A FAULTY SPLICE OR WIRE INSTALLATION WHICH SHALL BE CORRECTED BEFORE THE ROADWAY LOOP IS SEALED IN PLACE.

THE ROADWAY LOOP WIRE SHALL BE TERMINATED IN A WATERPROOF 4"x4"x4" PULL-BOX AT THE SIDE OF THE ROAD AND CONNECTED TO 2 CONDUCTOR UF WIRE WITH A SOLDERED, WATERPROOF SPLICE FOR THE LEAD-IN RUN.

THE PULL-BOX SHALL BE ENCASED IN A 2'-0" DIAMETER BY 6" DEEP CLASS "A" CONCRETE PAD, AS DETAILED



SOLID LINES SHOW SAW CUTS USED TO ACCOMMODATE ROADWAY WIRE LOOP. DOTTED LINES SHOW UNUSED SAW CUTS.

DRAWN 10-19-67

REVISED 11-1-68
EFFECTIVE 1-1-69

STANDARD DRAWING NO. 87-22

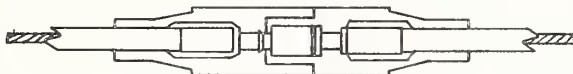
STATE HIGHWAY COMMISSION
HELENA, MONTANA

WATERTIGHT CONNECTORS

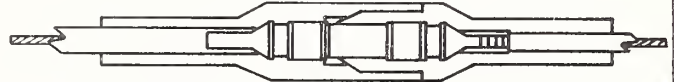
APPROVED

James M. Smith 11-22-68
STATE HIGHWAY ENGINEER

TYPES 1, 6 & 11



TYPES 2, 7, 12 & 16



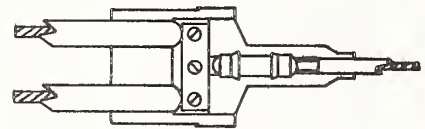
IDENTITY NO.	DESCRIPTIVE SYMBOL & WIRE SIZES
1	8 8
2	8 10
3	8 10
4	8 8
5	8 8
6	6 6
7	6 10
8	6 10
9	6 6
10	6 6
11	4 4
12	4 10
13	4 10
14	4 4
15	4 4
16	10 10
17	10 10
18	10 10

PLUG AND RECEPTACLE HOUSINGS SHALL BE MADE OF WATER-RESISTING, SYNTHETIC, RUBBER CAPABLE OF BURIAL IN THE GROUND OR INSTALLATION IN SUNLIGHT. EACH HOUSING SHALL PROVIDE A SECTION TO FORM A WATERTIGHT SEAL AROUND THE CABLE, AND A SECTION TO PROVIDE A WATER-SEAL BETWEEN THE TWO HOUSINGS AT THE POINT OF DISCONNECTION. EACH KIT SHALL BE SUPPLIED WITH SUFFICIENT SILICONE COMPOUND TO LUBRICATE METAL PARTS AND THE RUBBER HOUSINGS FOR EASY ASSEMBLY.

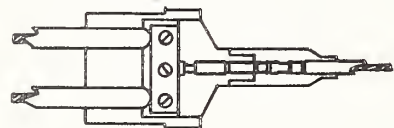
WHERE INDICATED A COPPER PIN AND A COPPER RECEPTACLE BOTH OF AT LEAST 90% CONDUCTIVITY SHALL BE CRIMPED TO THE CABLE. THE RECEPTACLE SHALL ESTABLISH CONTACT PRESSURE WITH THE PIN THROUGH THE USE OF A COPPER BERYLLIUM SPRING AND SHALL BE EQUIPPED WITH A DISPOSABLE MOUNTING PIN. THE PIN SHALL BE OF AT LEAST HALF-HARD MATERIAL AND THE CRIMPING PORTION SHALL BE FULLY ANNEALED WHILE THE REST OF THE PIN IS MAINTAINED IN ITS ORIGINAL STATE OF HARDNESS. THE RECEPTACLE SHALL BE FULLY ANNEALED. THE PIN AND RECEPTACLE SHALL LOCK TOGETHER SO THE CONNECTION WILL BE MAINTAINED WHEN A MINIMUM FORCE OF 20 POUNDS TENSION PULL IS APPLIED TO THE ATTACHED CABLES.

FUSED CONNECTOR KITS SHALL CONTAIN A PAIR OF SPRING LOADED 90% CONDUCTIVITY CONTACTS FOR GRIPPING A STANDARD MIDGET FERRULE TYPE FUSE. THE CONTACTS SHALL BE FULLY ANNEALED AND ADAPTED TO BE CRIMPED TO THE CABLE.

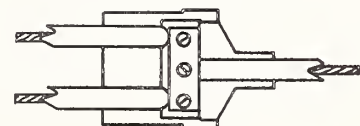
TYPES 3, 8, 13 & 17



TYPES 4, 9, 14 & 18



TYPES 5, 10 & 15



REVISED 8-7-61 11-22-68
EFFECTIVE 8-7-61 1-1-69

STANDARD DRAWING NO. 87-42

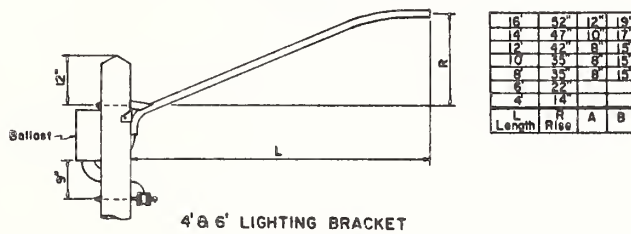
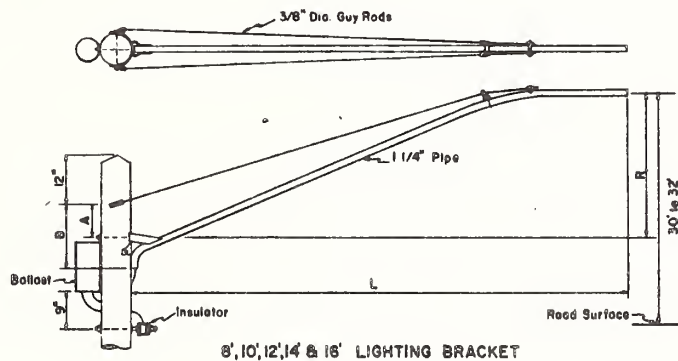
State Highway Commission
Helena, Montana

LIGHTING BRACKETS AND INSTALLATION DETAILS

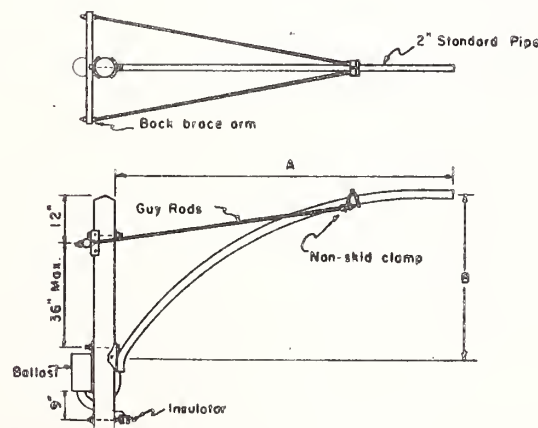
Approved

James A. Phillips 11-22-68
State Highway Engineer

TYPE 1 LIGHTING BRACKET



TYPE 2 LIGHTING BRACKET



Bracket Spread "A"	Rise of Arm "B"
6'	24"
8'	27"
10'	32"
12'	34"
14'	38"
16'	38"
18'	42"
20'	42"

REVISED	2-16-62	11-22-68
EFFECTIVE	2-16-62	1-1-69

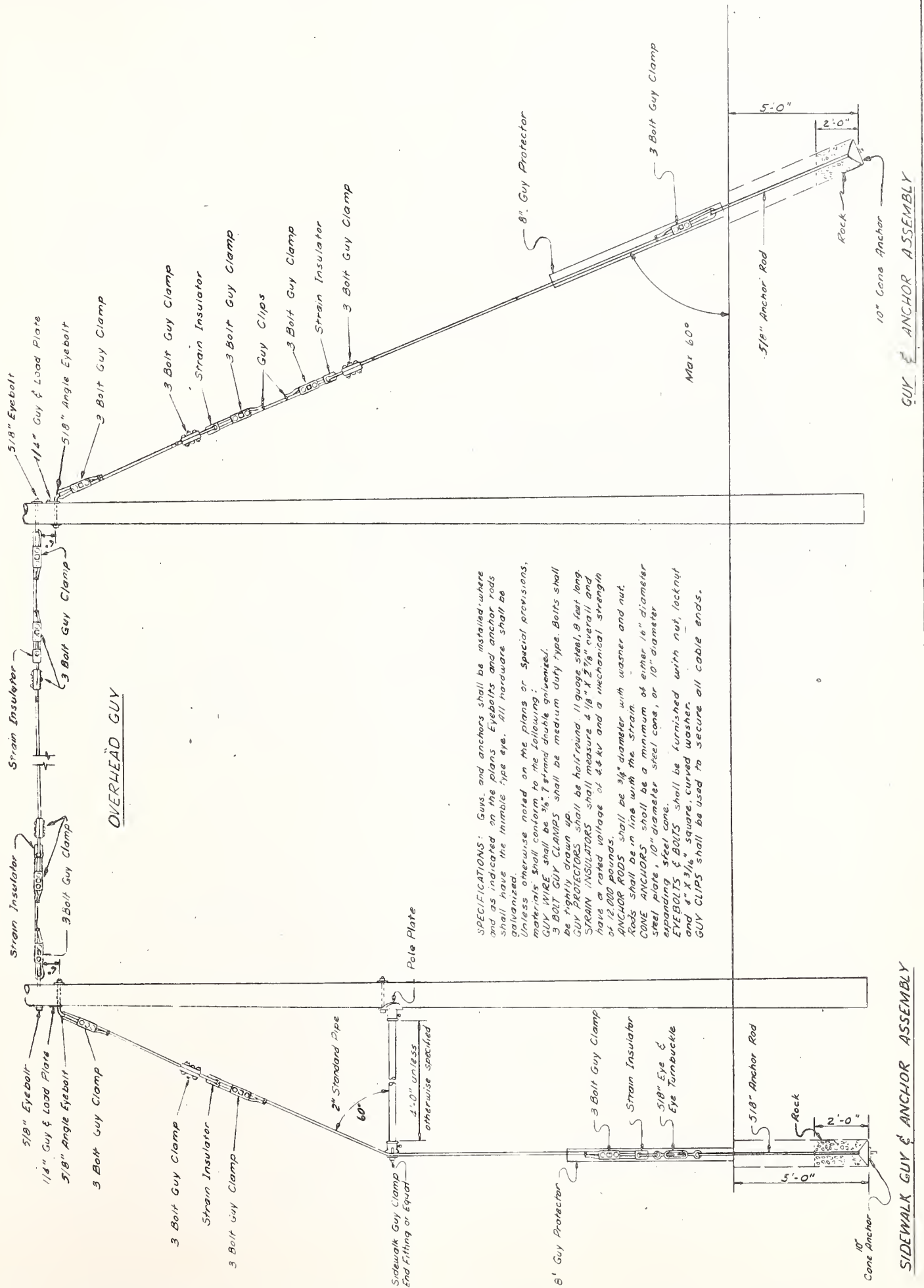
STANDARD DRAWING NO. 87-43

State Highway Commission
Helena, Montana

GUY & ANCHOR ASSEMBLIES

Approved

James M. Patton 11-22-68
State Highway Engineer



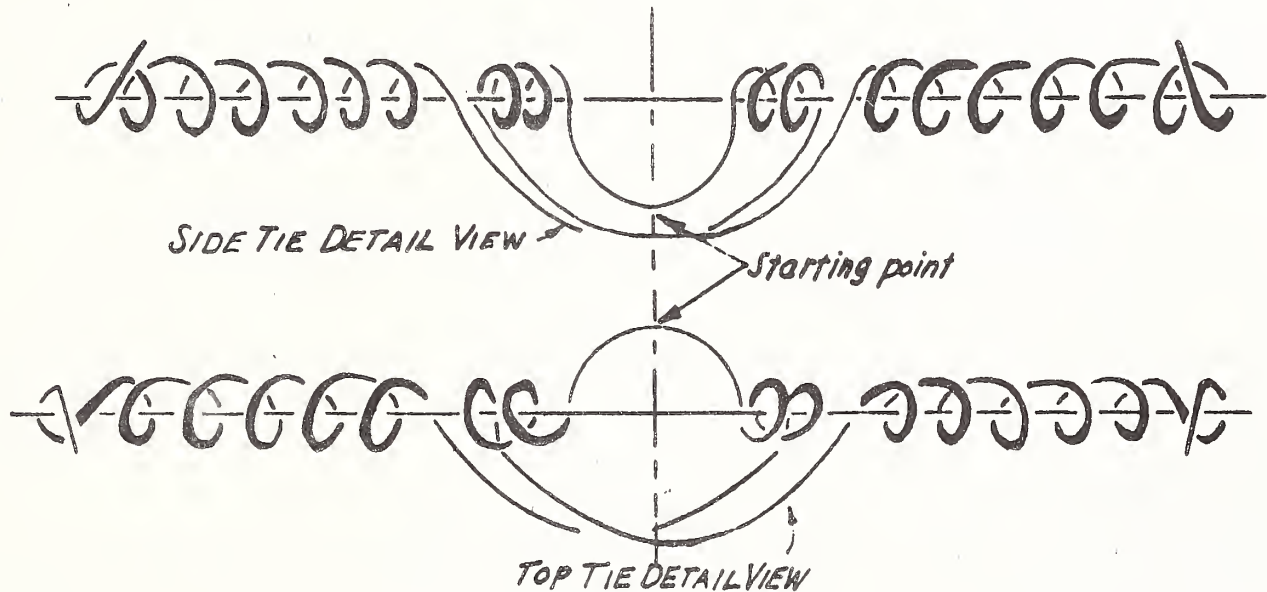
REVISED 2-1-59 11-22-68
EFFECTIVE 2-1-59 1-1-69

STANDARD DRAWING NO. 87-44

STATE HIGHWAY
COMMISSION
HELENA, MONTANA

TIE WIRE DETAIL

APPROVED
Lewis H. Patton 11-22-68
STATE HIGHWAY ENGINEER



CONDUCTOR	SIZE AWG	LENGTH		INCHES
		TOP TIE	SIDE TIE	
4 Copper Wire	6	50	56	
6 Copper Wire	8	46	52	
2 ACSR	4	54	60	
4 ACSR	6	50	56	

NOTE: Tie wire for copper conductor shall be fully annealed copper.

Tie wire for ACSR shall be aluminum.

REVISED 8-7-61 11-22-68
EFFECTIVE 8-7-61 1-1-69

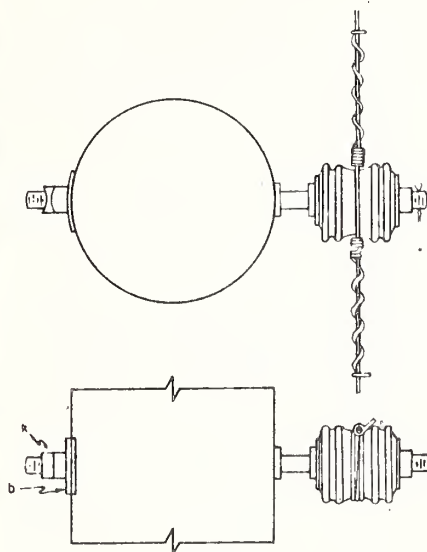
STANDARD DRAWING NO. 87-45

State Highway Commission
Helena, Montana

INSULATOR ASSEMBLY DETAILS

Approved

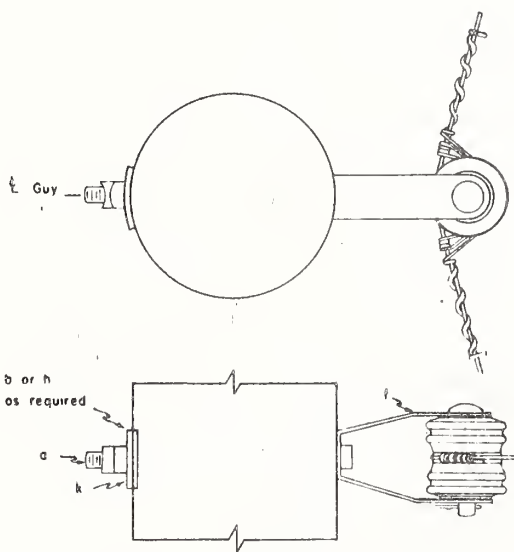
Lawrence D. Sullivan 11-22-68
State Highway Engineer



A. THRU ASSEMBLY

INSULATED UPSET BOLT

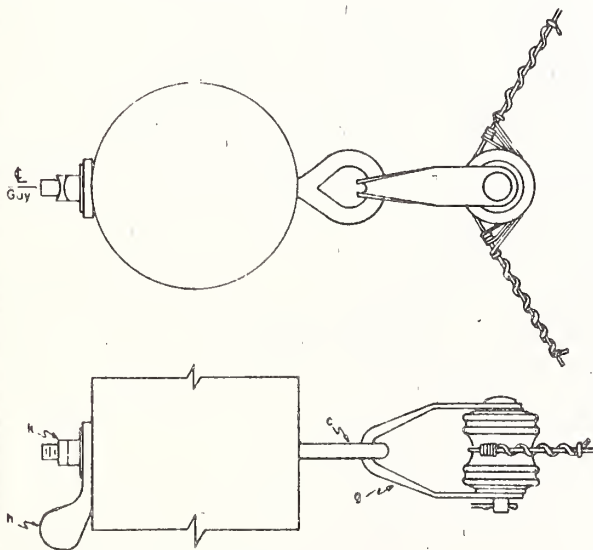
0°-5° ANGLE



B. ANGLE ASSEMBLY

INSULATED BRACKET

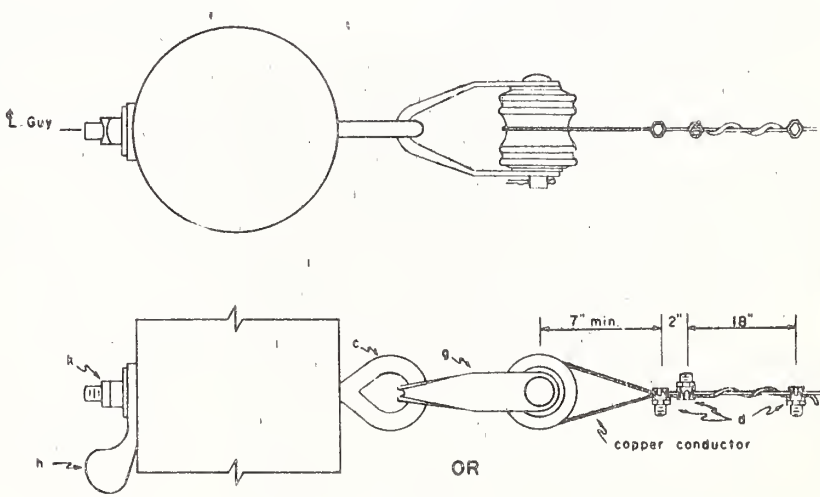
5°-30° ANGLE



C. ANGLE ASSEMBLY

INSULATED SWINGING CLEVIS

30°-60° ANGLE



D. DEAD END ASSEMBLY

INSULATED SWINGING CLEVIS

OVER 60° ANGLE

ITEM	MATERIAL
a	Bolt, machine, 5/8", x required length
b	Washer, 2 1/4" x 2 1/4" x 3/16", 3/16" hole
c	Bolt, eye, 5/8" x required length
d	Connectors, as required
e	Bolt, double upset, insulated
f	Bracket, insulated
g	Clevis, swinging, insulated
h	Guy attachment, 45° angle thimble eye.
k	Lock nut, MF
i	Dead-end loop

REVISED 2-1-59 11-22-68
EFFECTIVE 2-1-59 1-1-69

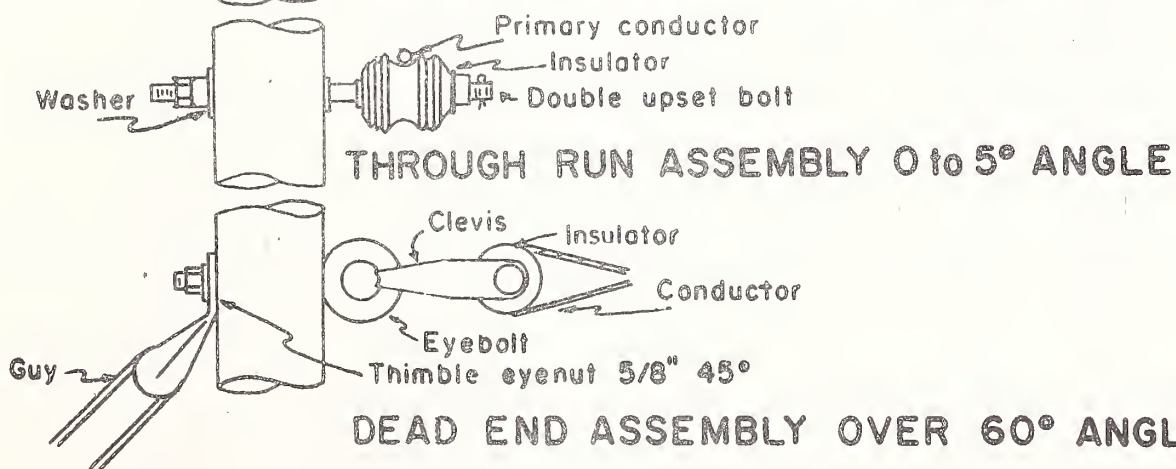
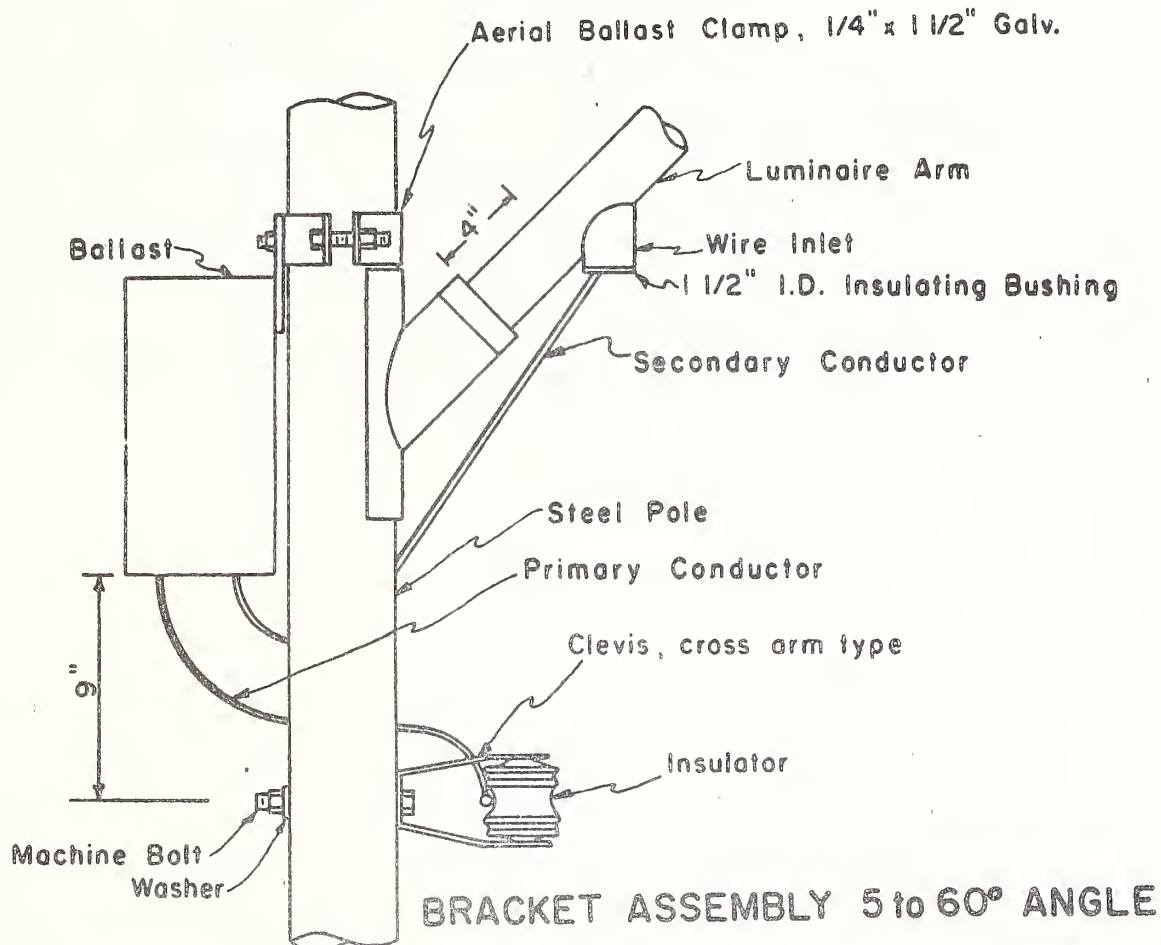
STANDARD DRAWING NO. 87-52

STATE HIGHWAY
COMMISSION
HELENA, MONTANA

INSTALLATION DETAILS OVERHEAD CONDUCTOR-STEEL POLES

APPROVED

Samuel D. Smith 11-22-68
STATE HIGHWAY ENGINEER



SIGN NO.	PANEL SIZE	LETTER SIZE	MARGIN	BORDER	CORNER RADIUS	HOLE CENTERS	
						VERT.	HORZ.
R1-1	24 X 24	8"C		5/8		18	
	30 X 30	10"C		3/4		24	
	36 X 36	12"C		1		30	
R1-2	36 X 36 X 36	6"D	3/8	5/8	1 1/2	24	
	60 X 60 X 60	10"D	5/8	1	2 1/2	40	
R2-1	24 X 30	4"E, 4"E, 10"E	3/8	5/8	1 1/2	24	
	48 X 60	8"D, 8"D, 16"D	3/4	7/8	3	26	30
R2-2A	24 X 30	4"D, 4"D, 4"D, 8"E	3/8	5/8	1 1/2	24	
	48 X 60	8"D, 8"D, 8"D, 16"E	3/4	7/8	3	26	30
R2-3A	24 X 30	4"D, 4"D, 4"D, 8"E		1/2	1 1/2	24	
	48 X 60	8"D, 8"D, 8"D, 16"E		1	3	26	30
R2-11	24 X 30	4"C	3/8	5/8	1 1/2	24	
	48 X 60	8"C	3/4	7/8	3	26	30
R2-12	132 X 84	10"D	1/2	2	12		
		8"D, 5"C					
		8"D					
		8"D					
R3-1 & R3-2	24 X 30	6"D, 5"D, 5"D	3/8	5/8	1 1/2	24	
	48 X 60	12"D, 10"D, 10"D	3/4	7/8	3	26	30
R3-4	24 X 30	5"D, 8"F, 5"D	3/8	5/8	1 1/2	24	
	48 X 60	10"D, 16"F, 10"D	3/4	7/8	3	26	30
R3-5	30 X 36	6"D	1/2	3/4	1 7/8	30	
R3-6	30 X 36		1/2	3/4	1 7/8	30	
R3-7	30 X 30	4"C, 5"C, 4"C	1/2	3/4	1 7/8	24	
R3-8	30 X 30	4"D	1/2	3/4	1 7/8	24	
R4-1	24 X 30	6"D	3/8	5/8	1 1/2	24	
	48 X 60	12"D	3/4	7/8	3	26	30
R4-2	24 X 30	6"C	3/8	5/8	1 1/2	24	
	48 X 60	12"C	3/4	7/8	3	26	30
R4-3	24 X 30	4"D	3/8	5/8	1 1/2	24	
	48 X 60	8"D	3/4	7/8	3	26	30
R4-7	24 X 30	5"D		1/2	1 1/2	24	
	48 X 60	10"D		1	3	26	30
R4-10	24 X 30	3"C	3/8	5/8	1 1/2	24	
	48 X 60	6"C	3/4	7/8	3	26	30
R4-11	24 X 30	4"D, 4"C, 4"C, 4"C	3/8	5/8	1 1/2	24	
	48 X 60	8"D, 8"C, 8"C, 8"C	3/4	7/8	3	26	30
R5-1	24 X 24	6"C	3/8	5/8	1 1/2	18	
	36 X 36	8"D	5/8	7/8	2 1/4	30	
R6-1	36 X 12	4"D		3/8	1 1/2	9	
R6-3	24 X 30	5"C	3/8	5/8	1 1/2	24	
	48 X 60	10"C	3/4	7/8	3	26	30
R6-8	24 X 30	5"C	3/8	5/8	1 1/2	24	
R6-4	24 X 30	6"D	3/8	5/8	1 1/2	24	
RIO-1	24 X 30	5"C	3/8	5/8	1 1/2	24	
	48 X 60	10"C	3/4	7/8	3	26	30

SIGN NO.	PANEL SIZE	LETTER SIZE	MARGIN	BORDER	CORNER RADIUS	HOLE CENTERS	
						VERT.	HORZ.
W1-1	30 X 30		1/2	3/4	1 7/8	30	
W1-2	30 X 30		1/2	3/4	1 7/8	30	
	36 X 36		5/8	7/8	2 1/4	36	
	48 X 48		3/4	1 1/4	3	22	36
W1-3	30 X 30		1/2	3/4	1 7/8	30	
W1-4	30 X 30		1/2	3/4	1 7/8	30	
	36 X 36		5/8	7/8	2 1/4	36	
	48 X 48		3/4	1 1/4	3	22	36
W1-5	30 X 30		1/2	3/4	1 7/8	30	
	36 X 36		5/8	7/8	2 1/4	36	
W1-6	48 X 24		1/2	3/4	1 7/8	18	30
W1-7							
W3-1	30 X 30	6"D, 6"C	1/2	3/4	1 7/8	30	
	36 X 36	7"D, 7"C	5/8	7/8	2 1/4	36	
W3-2	30 X 30	6"C	1/2	3/4	1 7/8	30	
	36 X 36	7"C	5/8	7/8	2 1/4	36	
W3-3	36 X 36	6"D	5/8	7/8	2 1/4	36	
W4-1	30 X 30	5"C	1/2	3/4	1 7/8	30	
	36 X 36	6"C	5/8	7/8	2 1/4	36	
	48 X 48	8"C	3/4	1 1/4	3	22	36
W4-2	36 X 36	SEE STANDARD DRWG. NO. 88-16	5/8	7/8	2 1/4	36	
	48 X 48		3/4	1 1/4	3	22	36
W5-1	30 X 30	5"D	1/2	3/4	1 7/8	30	
	36 X 36	6"D	5/8	7/8	2 1/4	36	
W6-1	36 X 36	5"D	5/8	7/8	2 1/4	36	
	48 X 48	7"D	3/4	1 1/4	3	22	36
W6-2	36 X 36	5"D	5/8	7/8	2 1/4	36	
	48 X 48	7"D	3/4	1 1/4	3	22	36
W6-4	48 X 48	9"C, 9"C	3/4	1 1/4	3	22	36
W6-5	30 X 30	6"C, 6"C	1/2	3/4	1 7/8	30	
	36 X 36	8"C, 8"C	5/8	7/8	2 1/4	36	
W10-1	36 DIA.	8"E, 3 3/4" BARS	1/2	3/4		30	
W12-3	30 X 15	6"C NUMERALS 8"C LETTERS	3/8	7/8	1 7/8	24	
W13-1	18 X 18	8"C, 3"E	3/8	3/8	1 1/2	15	
	24 X 24	10"C, 4"E	3/8	5/8	1 1/2	18	
W13-5	30 X 36	5E, 10E, 4E	1/2	3/4	1 7/8	30	
	48 X 60	8E, 16E, 6E	3/4	7/8	3	26	30
X1-1	12 X 24	3 5/8" BARS			1 1/2	18	
	12 X 36				1 1/2	30	
X3-2	15 X 15	NINE 3" REFLECTOR BUTTONS			1 1/2	15	
	18 X 18				1 1/2	15	

Drawn 3-1-66	REVISED 11-1-68 EFFECTIVE 1-1-69	STANDARD DRAWING NO.	88-04
State Highway Commission Helena, Montana		ROUTE MARKER PANEL SPECIFICATIONS Approved 11-4-68 <i>Levinson</i> State Highway Engineer	

SIGN NO.	PANEL SIZE	LETTER SIZE	MARGIN	BORDER	CORNER RADIUS	HOLE CENTERS	
						VERT.	HORZ.
M1-1	24 X 24 28 X 24	3" E, 10" D	9/16	3/4		18	
M1-2	24 X 24	1 DIGIT 12" D 2 DIGIT 12" C			1 1/2	18	
M1-3	21 X 18	1 7/8" C 1 1/8" D 6" D		9/16		15	
M1-4	24 X 24	2 1/2" C 1 1/2" D 8" D		3/4		18	
	36 X 36	3 3/4" C 2 1/4" D 12" D		1 1/8		30	
M1-5	24 X 24	2 1/2" C 1 1/2" D 8" D		3/4		18	
	36 X 36	3 3/4" C 2 1/4" D 12" D		1 1/8		30	
M1-6	24 X 24	1 DIGIT 10" E 2 DIGIT 10" D 3 DIGIT 10" C		1 1/2	1 1/2	18	
M1-7	24 X 24	7" C			1 1/2	18	
M2-1 M2-1A	21 X 15	9" C	3/8 *	3/8	1 1/2	12	
M3-1 M3-1A THRU M4-7	21 X 15		3/8 *	3/8	1 1/2	12	18 †
M5-1	21 X 9	4" B	3/8	3/8	1 1/2	6	18 †
M5-2	21 X 9	4" B	3/8	3/8	1 1/2	6	18 †
M5-3	21 X 9	5" B	3/8	3/8	1 1/2	6	18 †
M5-5	21 X 9	4" B	3/8	3/8	1 1/2	6	18 †
M5-6	21 X 9	5" B	3/8	3/8	1 1/2	6	18 †
M6-1 M6-1A THRU M6-4 M6-4A	21 X 9	5" C	3/8 *	3/8	1 1/2	6	18 †
M6-1B THRU M6-4B	30 X 15	7" C		1/2	2	12	
M7-1	18 X 12	7" C	3/8	3/8	1/2	9	15 †

NOTES

(†) Holes for these signs must be spaced horizontally when mounted with back braces. See Standard Drawings No. 88-78 & 88-79. Generally speaking, the vertical hole spacing will only be necessary when a single column of route markers is mounted on a treated timber post.

(*) Signs having numbers ending in A or B shall not have a margin.

Drawn 3-1-63

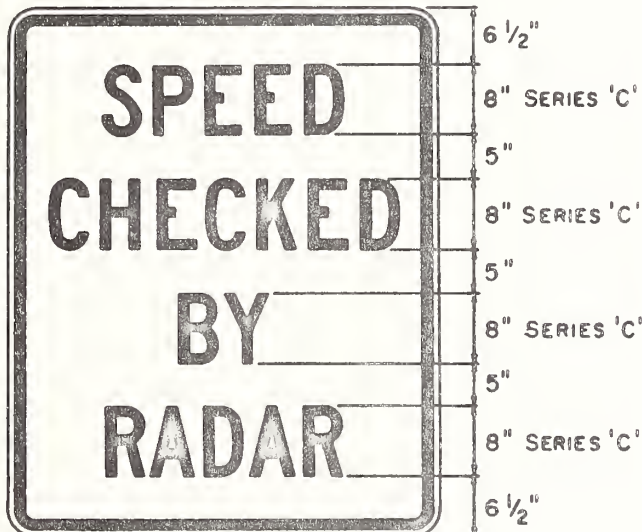
Revised 3-1-67
Effective 6-1-67

STANDARD DRAWING NO. 88-06

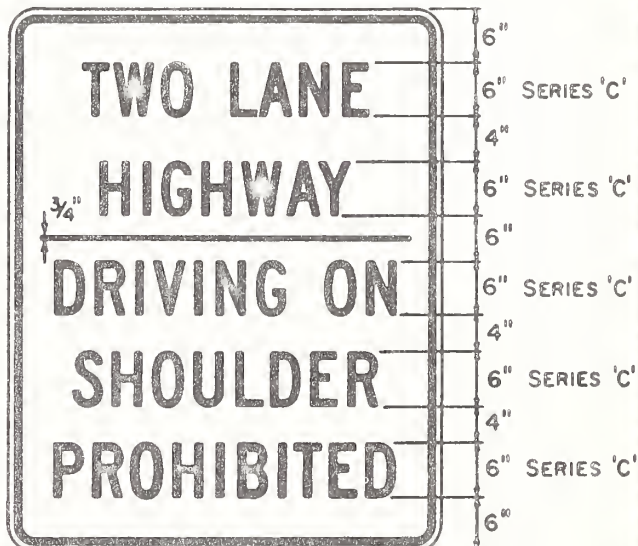
State Highway Commission
Helena, Montana

R2-11, R4-10, R4-11 & R4-7

Approved
James M. Sullivan
State Highway Engineer



R2-11



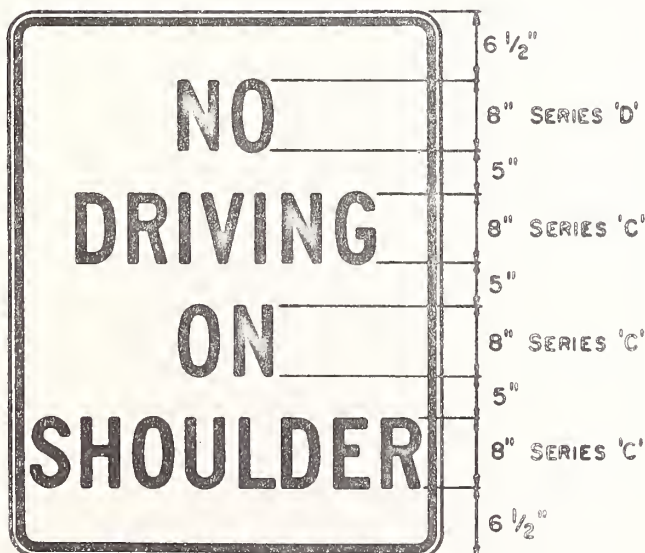
R4-10

NOTE

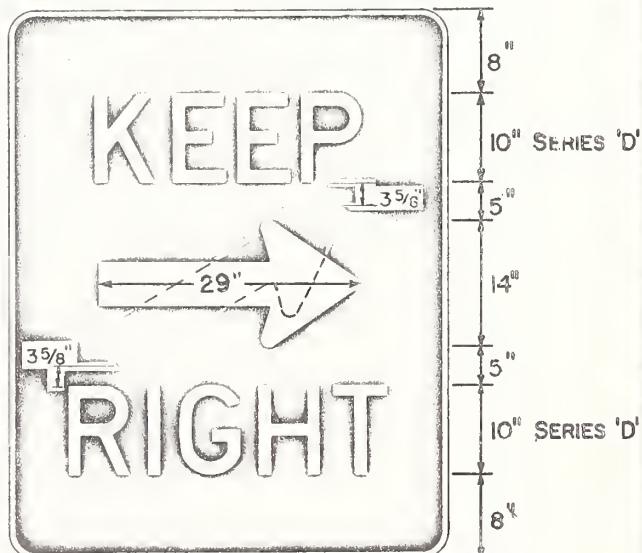
ALL SIGNS ON THIS SHEET ARE 48" X 60".

THE R2-11, R4-10 & R4-11 SIGNS HAVE $\frac{3}{4}$ " MARGINS $\frac{7}{8}$ " BORDERS AND 3" CORNER RADII. THEY ARE BLACK ON REFLECTORIZED WHITE.

THE R4-7 SIGN IS REFLECTORIZED WHITE ON BLACK WITH A 1" BORDER AND 3" CORNER RADII.



R4-11

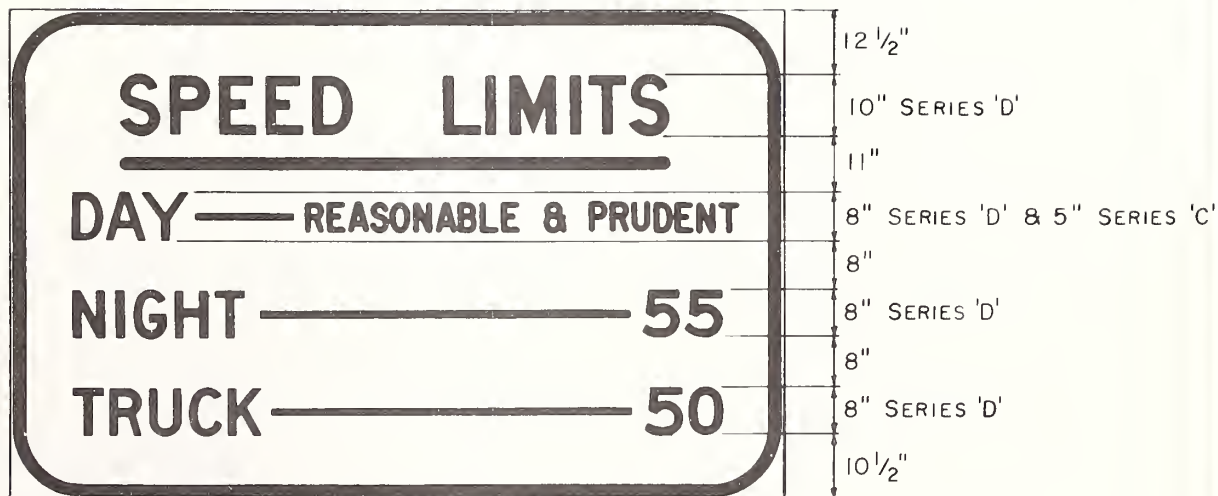


R4-7 (HORIZONTAL ARROW)

R4-8 (30° ARROW)

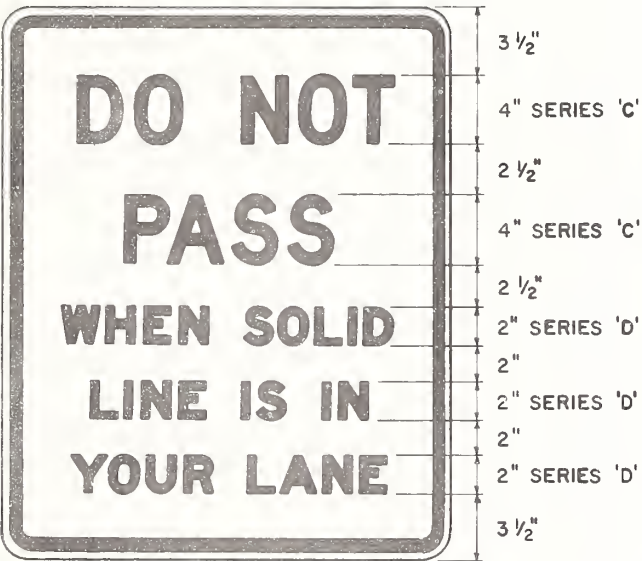
Drawn 3-1-63	REVISED	9-16-64	9-1-70	STANDARD DRAWING NO. 88-07
	EFFECTIVE	9-16-64	1-1-71	
State Highway Commission Helena, Montana		STANDARD R2-12 SIGN		
		Approved <i>[Signature]</i> State Highway Engineer		

R2-12, BLACK LEGEND ON
A WHITE REFLECTORIZED BACKGROUND

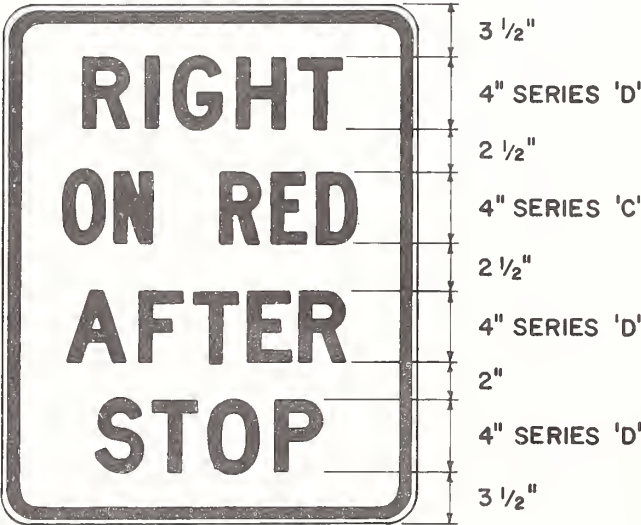


R2-12
132" X 84"

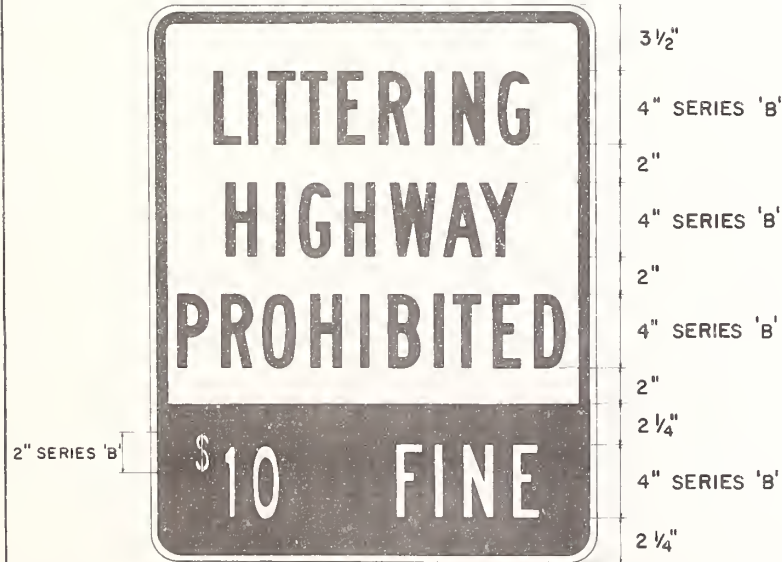
NOTE:
CENTER 1 1/2" BAR BETWEEN LINES 1 & 2
DASHES IN LINES 2, 3, & 4 ARE 1" WIDE.
THE MARGIN IS 1/2" AND THE BORDER IS 2".
THE CORNER RADIUS IS 12".



R4-12
 24 X 30
 MARGIN = 3/8"
 BORDER = 5/8"
 CORNER RADIUS = 1 1/2"



R4-13
 24 X 30
 MARGIN = 3/8"
 BORDER = 5/8"
 CORNER RADIUS = 1 1/2"



R10-8
 24 X 30
 MARGIN = 3/8"
 BORDER = 5/8"
 CORNER RADIUS = 1 1/2"

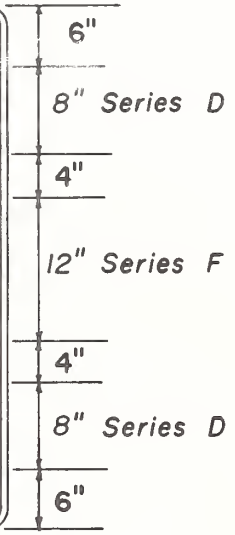
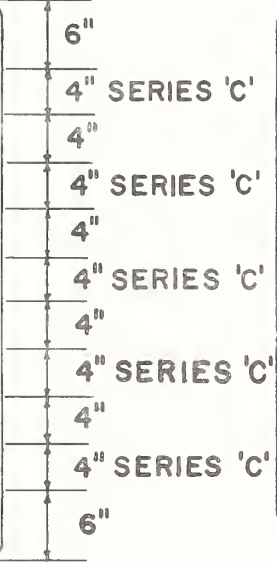
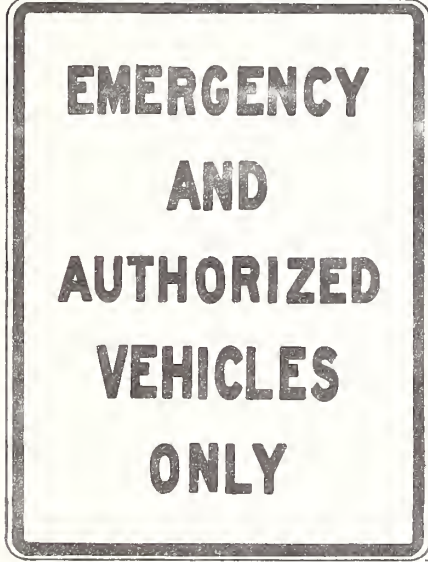
State Highway Commission
Helena, Montana

SIGNING OF MEDIAN U - TURNS

Approved
[Signature]
State Highway Engineer

R3-10
36 x 48

R3-4



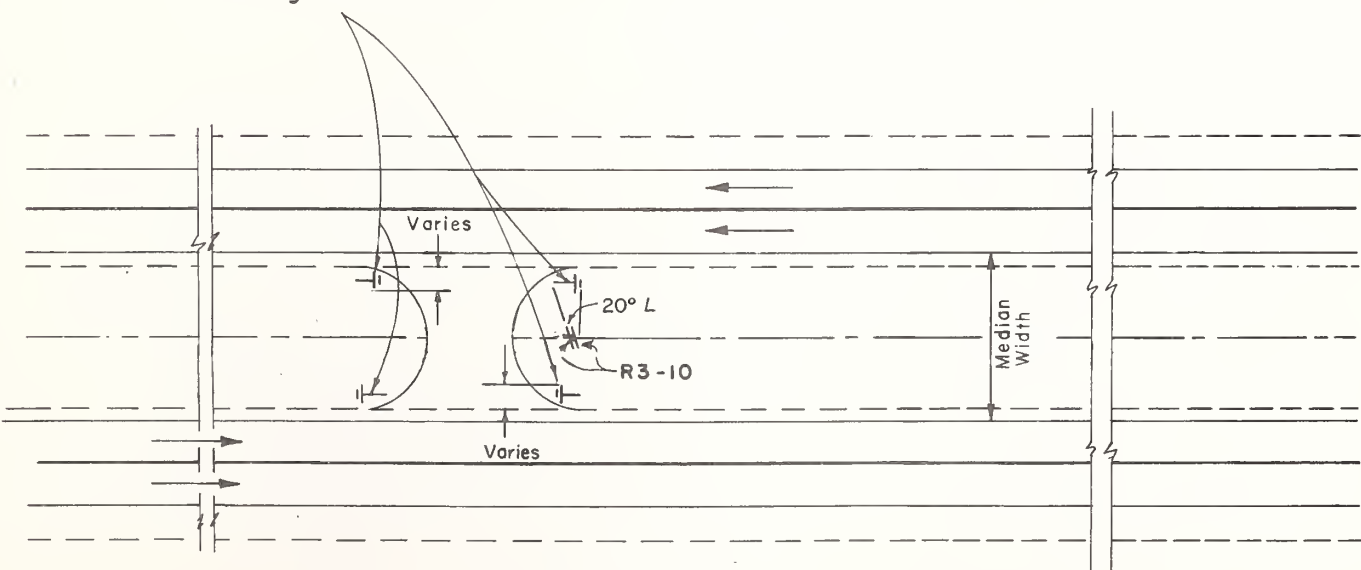
Margin = $\frac{5}{8}$ "
Border = $\frac{7}{8}$ "
Corner Radius = 2"

Note:

R3-4 and R3-10 Shall have black legend on White reflectorized background.

For median widths of 76 feet or less, R3-10 Signs shall be mounted back to back. They shall be placed at the centerline of the median and on the side of the U-turn away from the nearest interchange. Median widths greater than 76 feet will require seperate installations on either side of the U-turn at specified clearance. For openings through median guard rails, the sign post shall be placed in line with guard rail post.

Design 'B' delineator as specified in Standard Drawing No. 88-91



U - TURN MEDIAN OPENINGS
(See Std. Dwg. 11-03)

Drawn 5-1-65

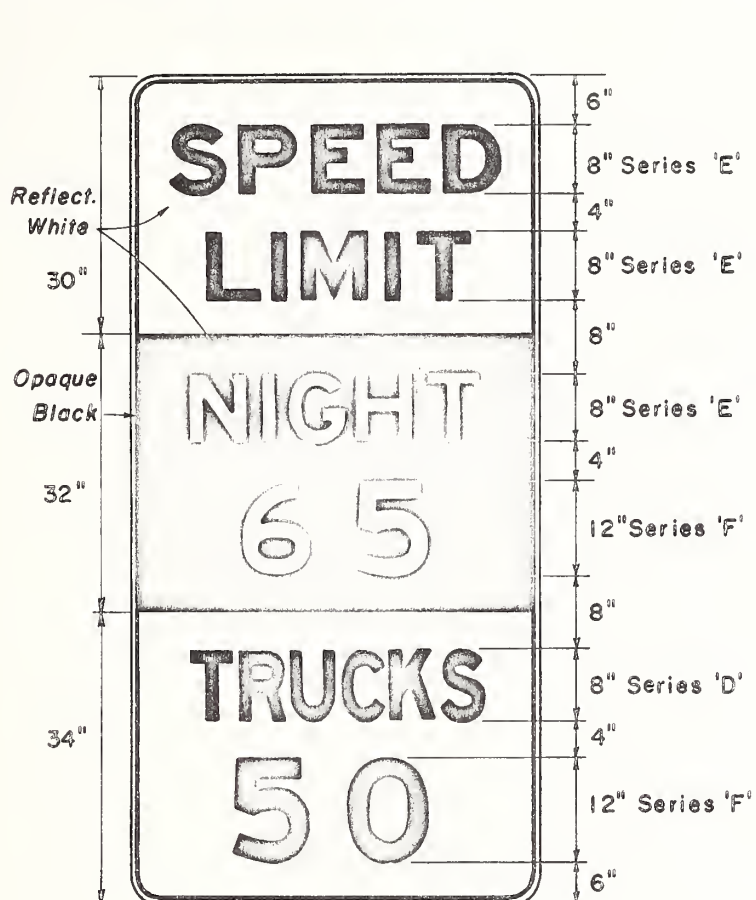
Revised 3-1-67
Effective 6-1-67

STANDARD DRAWING NO. 88-10

State Highway Commission
Helena, Montana

STANDARD R2-8 SIGN

Approved
James M. Putnam
State Highway Engineer



R2-8A
48" x 96"
Margin = $\frac{3}{4}$ "
Border = $\frac{7}{8}$ "
Corner Radius = 3"

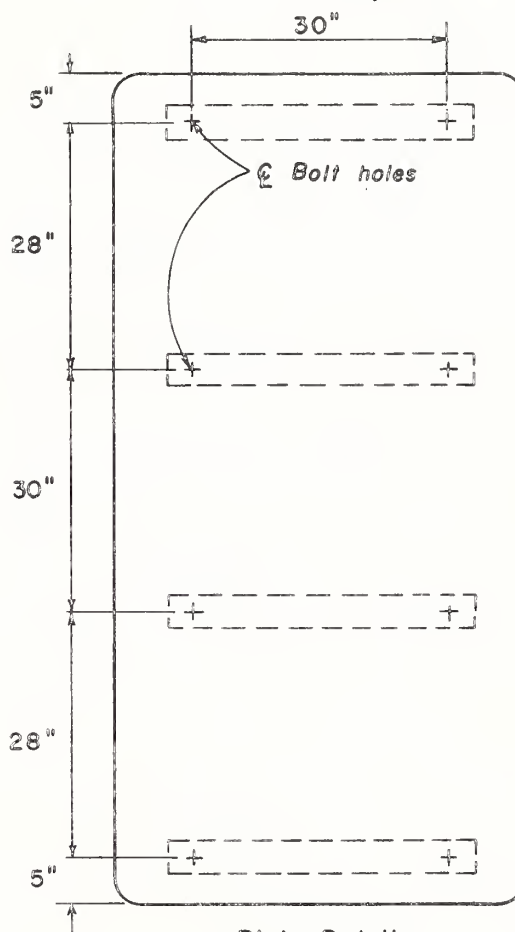
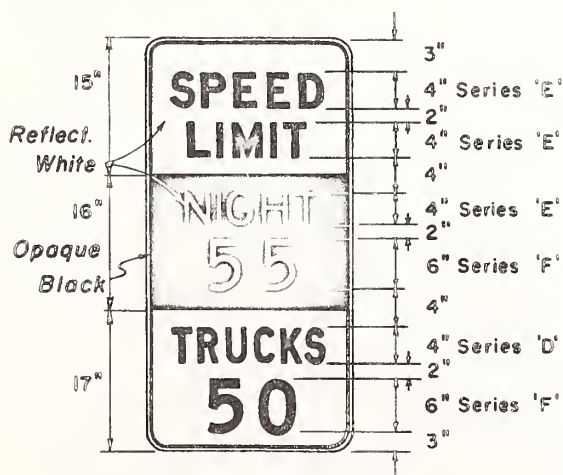


Plate Details



R2-8B
24" x 48"
Margin = $\frac{3}{8}$ "
Border = $\frac{5}{8}$ "
Corner Radius = 1 1/2"

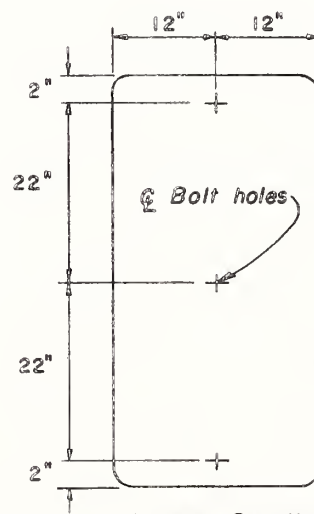
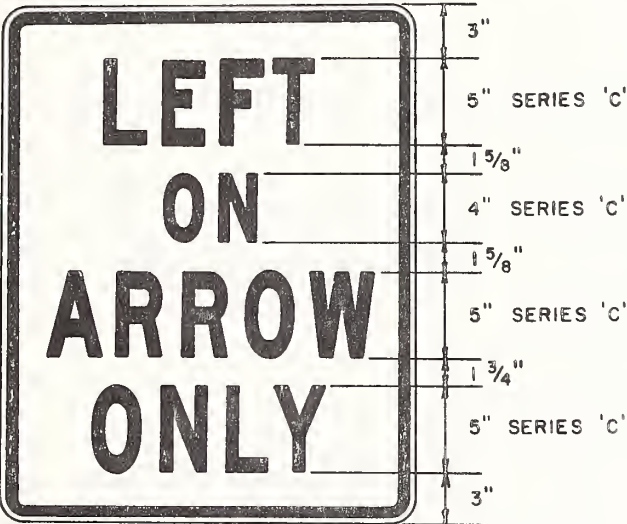
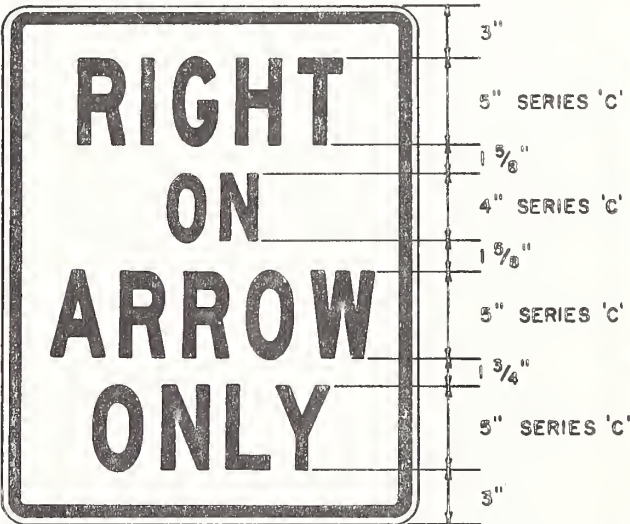


Plate Details

Drawn	9-26-68	REVISED		STANDARD DRAWING NO.	88 - 11
		EFFECTIVE	1-1-69		
State Highway Commission Helena, Montana		R4-14, R4-15			Approved <i>Paul H. Patterson 11-7-68</i> State Highway Engineer



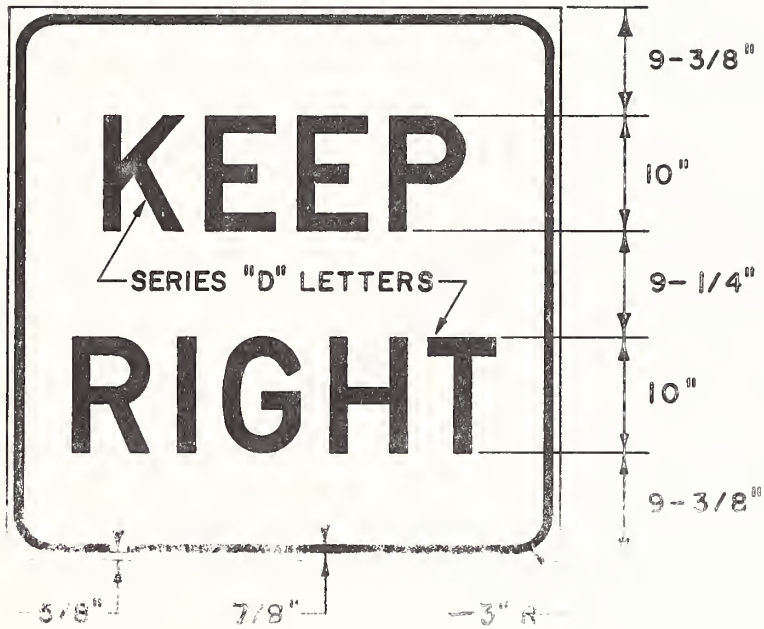
R4-14
24 X 30
MARGIN = $\frac{3}{8}$ "
BORDER = $\frac{5}{8}$ "
CORNER RADIUS = $1\frac{1}{2}$ "



R4-15
24 X 30
MARGIN = $\frac{3}{8}$ "
BORDER = $\frac{5}{8}$ "
CORNER RADIUS = $1\frac{1}{2}$ "

Drawn <u>8-15-68</u>	Checked <u>11-1-68</u>	STANDARD DRAWING NO. 88-12
State Highway Commission Helena, Montana	R4-9	Approved <i>James M. Chilton</i> 9-22-68 State Highway Engineer

R4-9
48" X 48"



Drawn 3-1-63

REVISED
EFFECTIVE

3-1-63

9-1-70

7-9-71

1-1-71

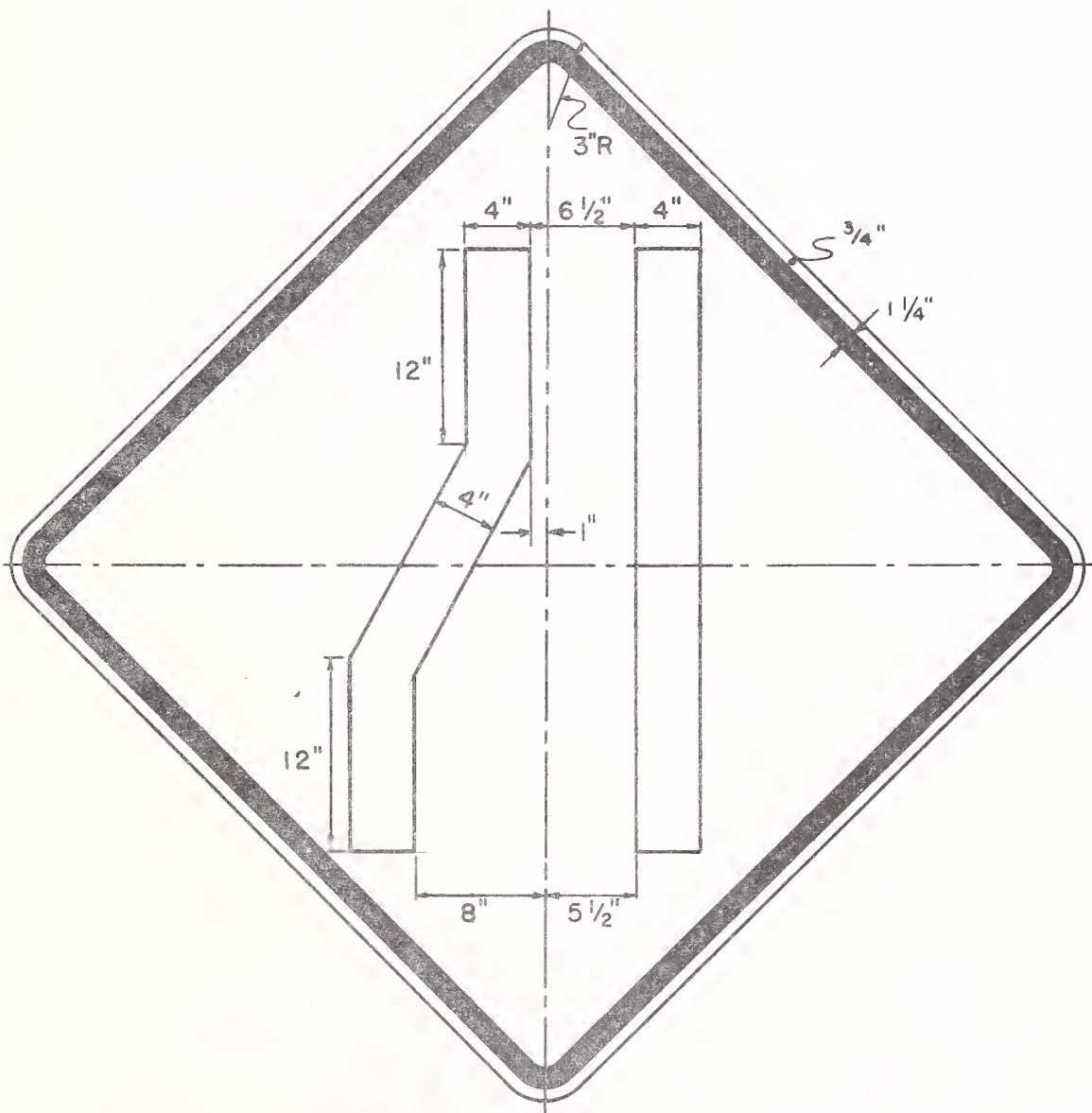
STANDARD DRAWING NO. 88-16

State Highway Commission
Helena, Montana

STANDARD W4-2 WARNING SIGN

Approved

Paul H. Gillingham
State Highway Engineer



W4-2
48" X 48"

BLACK ON REFLECTORIZED YELLOW

Drawn 4-1-64

REVISED 10-1-64
EFFECTIVE 10-1-64

STANDARD DRAWING NO. 88-17

State Highway Commission
Helena, Montana

W6-4, W6-5, W12-3, & X3-2 WARNING SIGNS

Approved
State Highway Engineer

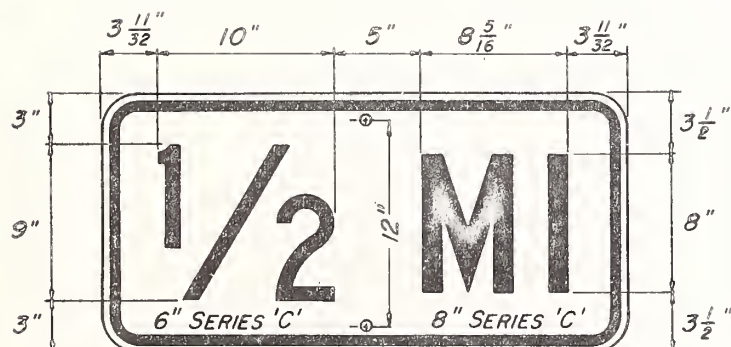


W6-4
48" X 48"



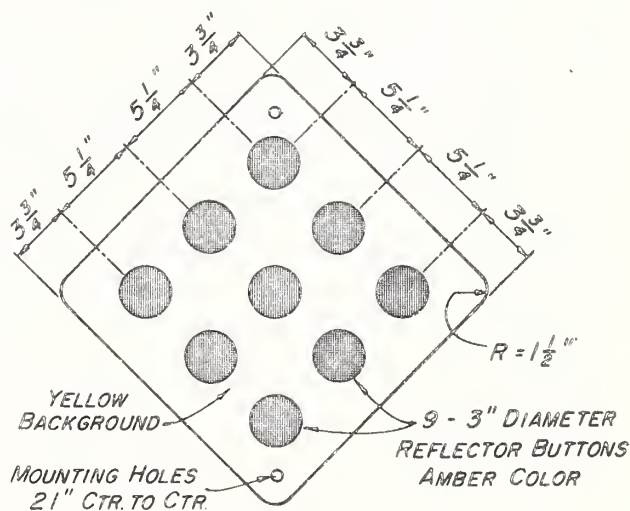
W6-5
30" X 30"

BLACK LEGEND ON A YELLOW REFLECTORIZED BACKGROUND



W12-3
30" X 15"

BORDER = $\frac{7}{8}$ "
MARGIN = $\frac{3}{8}$ "
CORNER RADIUS = $1\frac{7}{8}$ "



X3-2
18" X 18"

Drawn 6-19-68

Revised
Effective

11-1-68

9-1-70
1-1-71

STANDARD DRAWING NO. 88-18

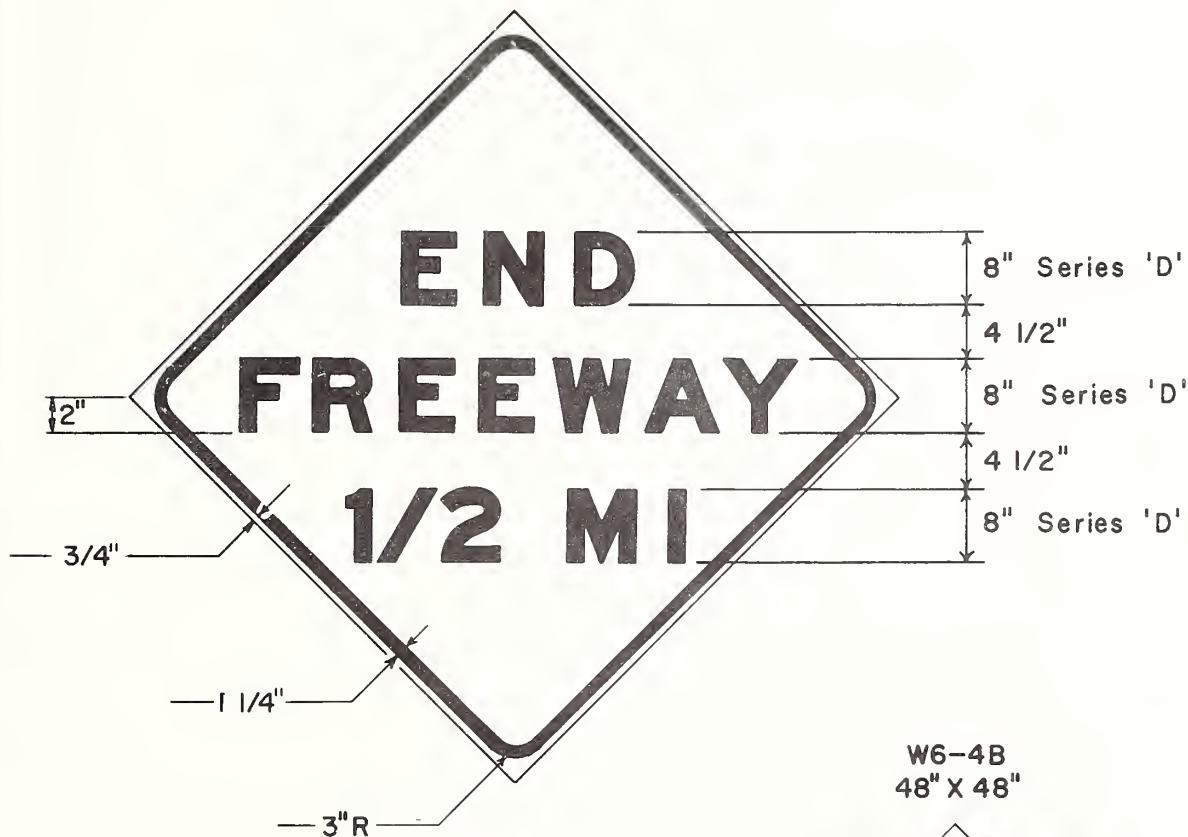
State Highway Commission
Helena, Montana

W6-4A & W6-4B

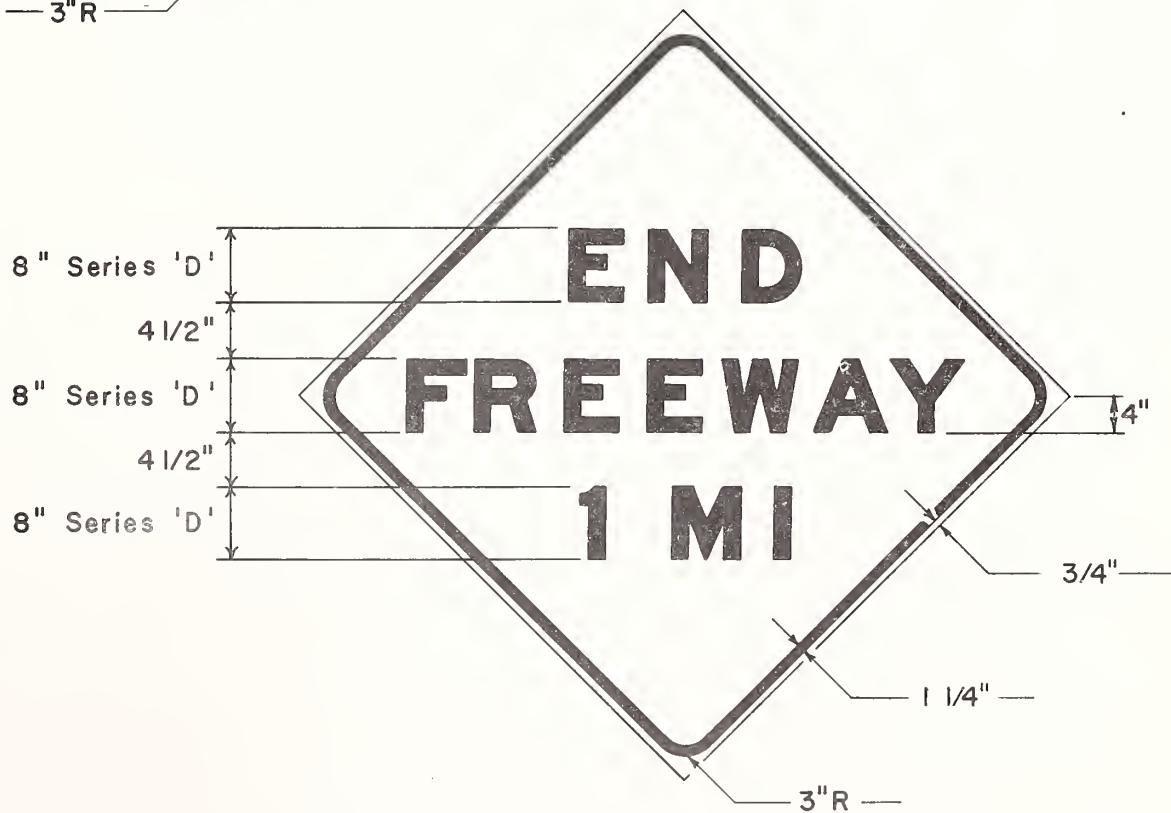
Approved

[Signature]
State Highway Engineer

W6-4A
48" X 48"



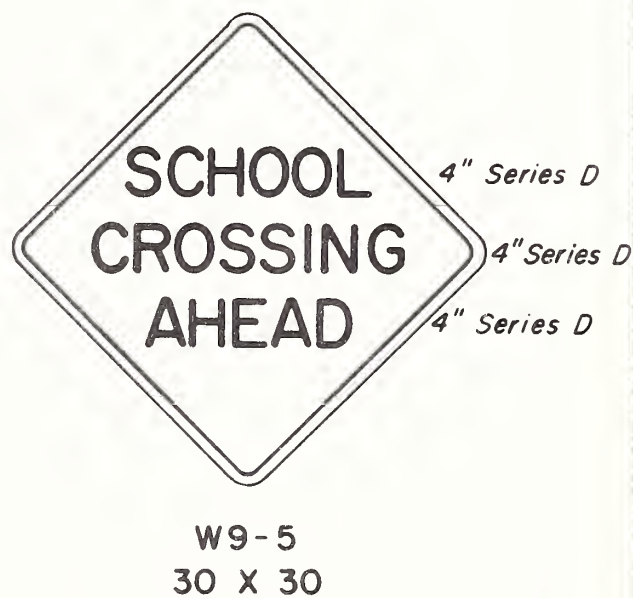
W6-4B
48" X 48"





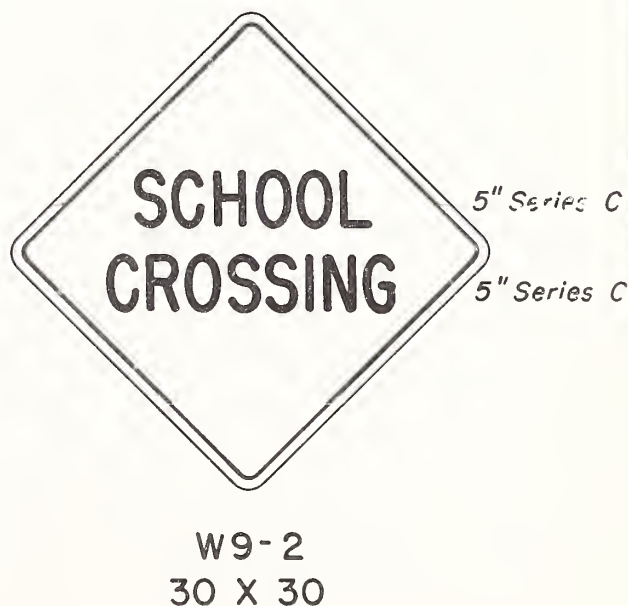
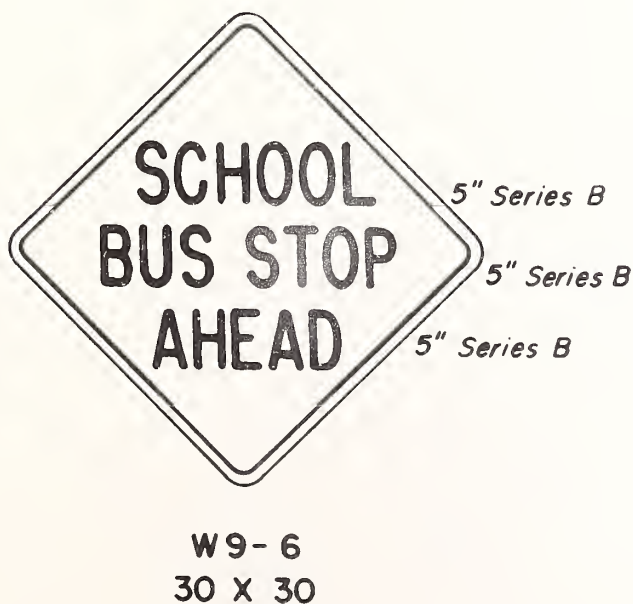
NOTE

Warning sign W8-9 shall have black legend and borders on a reflectorized yellow background. The Bureau of Public Roads "STANDARD ALPHABET" shall be used.

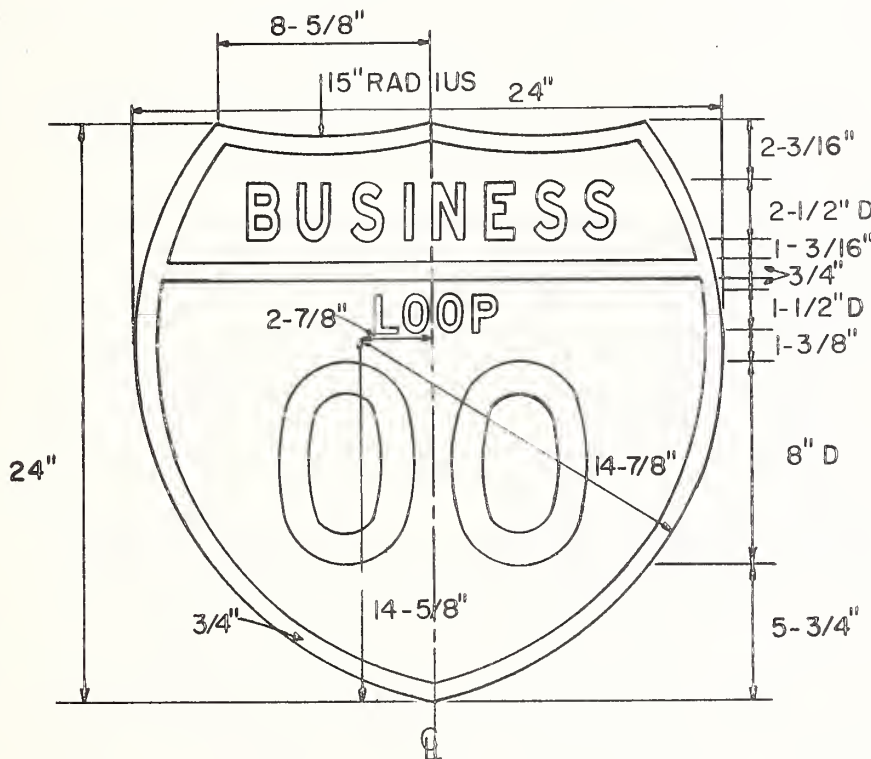


NOTE

Warning signs W9-2, W9-5, & W9-6 shall have black legend and borders on a yellow background. The Bureau of Public Roads "STANDARD ALPHABET" shall be used.

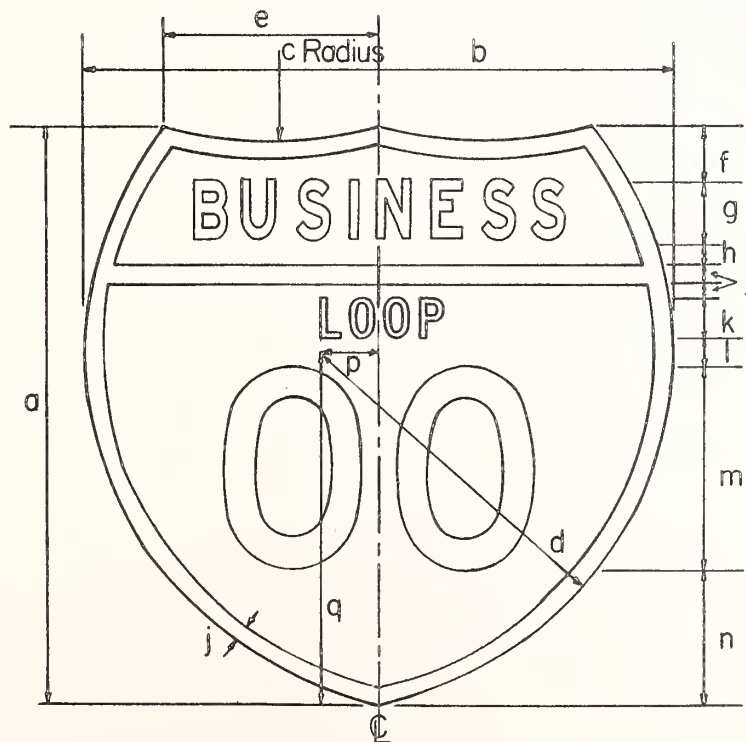


BUSINESS INTERSTATE SHIELD
INDEPENDENT



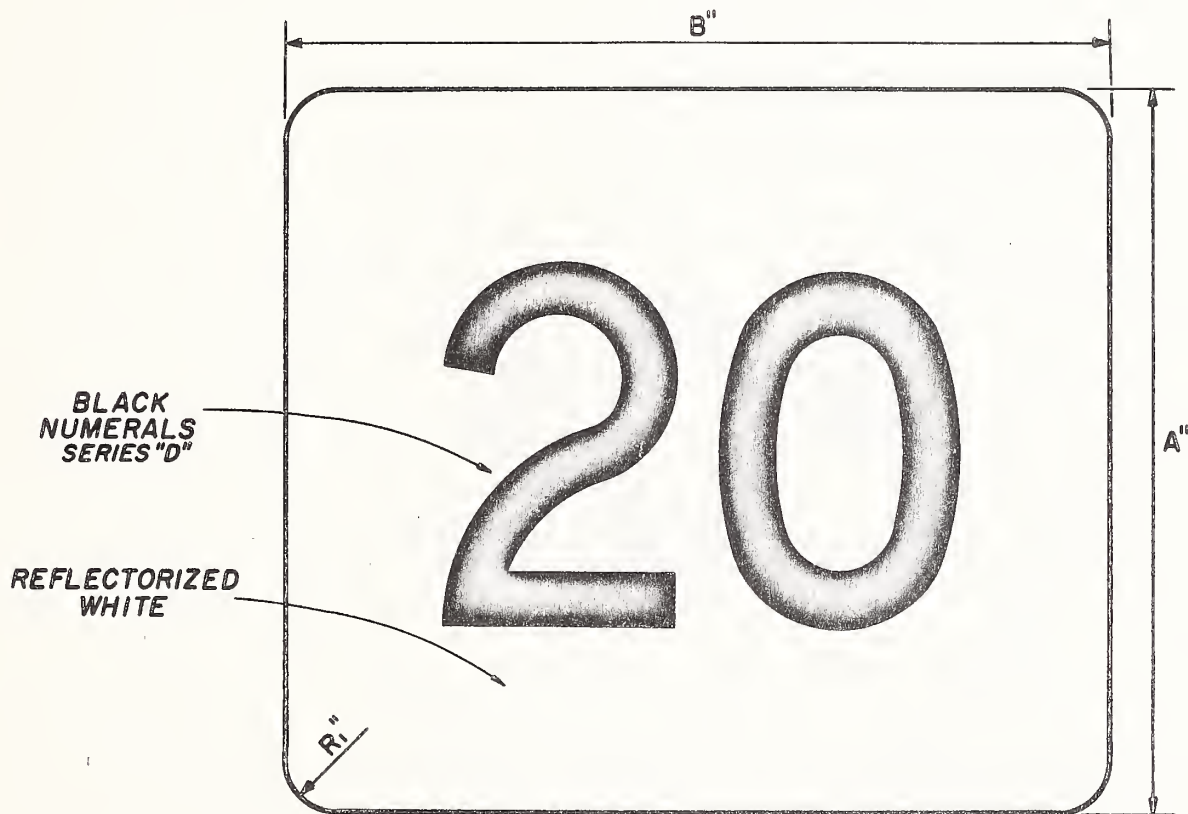
NOTE:
ROUTE MARKERS WILL BE REFLECTORIZED
WITH WHITE LEGEND, NUMERALS AND
BORDERS ON A STANDARD INTERSTATE
GREEN COLOR BACKGROUND.

BUSINESS INTERSTATE SHIELD
GUIDE SIGNS



	8"	12"	16"
	NUMERALS	NUMERALS	NUMERALS
	2 DIGITS	2 DIGITS	2 DIGITS
a	24	36	48
b	24	36	48
c	15	22 - 1/2	30
d	14 - 7/8	22 - 5/16	29 - 3/4
e	8 - 5/8	12 - 15/16	17 - 1/4
f	2 - 3/16	3 - 9/16	4 - 3/4
g	2 - 1/20	3 - 3/40	5 C
h	1 - 3/16	1 - 1/2	2
j	3/4	1 - 1/8	1 - 1/2
k	1 - 1/20	2 - 1/40	3 C
l	1 - 3/8	2 - 1/16	2 - 3/4
m	8 D	12 D	16 D
n	5 - 3/4	8 - 5/8	11 - 1/2
p	2 - 7/8	4 - 5/16	5 - 3/4
q	14 - 5/8	21 - 15/16	29 - 1/4

Drawn 4-1-65	REVISED EFFECTIVE 4-1-65	STANDARD DRAWING NO. 88-27
State Highway Commission Helena, Montana	PRIMARY ROUTE MARKER FOR USE ON GUIDE SIGNS	
		Approved <i>[Signature]</i> State Highway Engineer



10" NUMERAL		12" NUMERAL		15" NUMERAL	
2 DIGITS	3 DIGITS	2 DIGITS	3 DIGITS	2 DIGITS	3 DIGITS
A 21	21	27	27	33	33
B 24	30	30	36	36	42
R _i 1½		2		2½	

Drawn 9-1-64

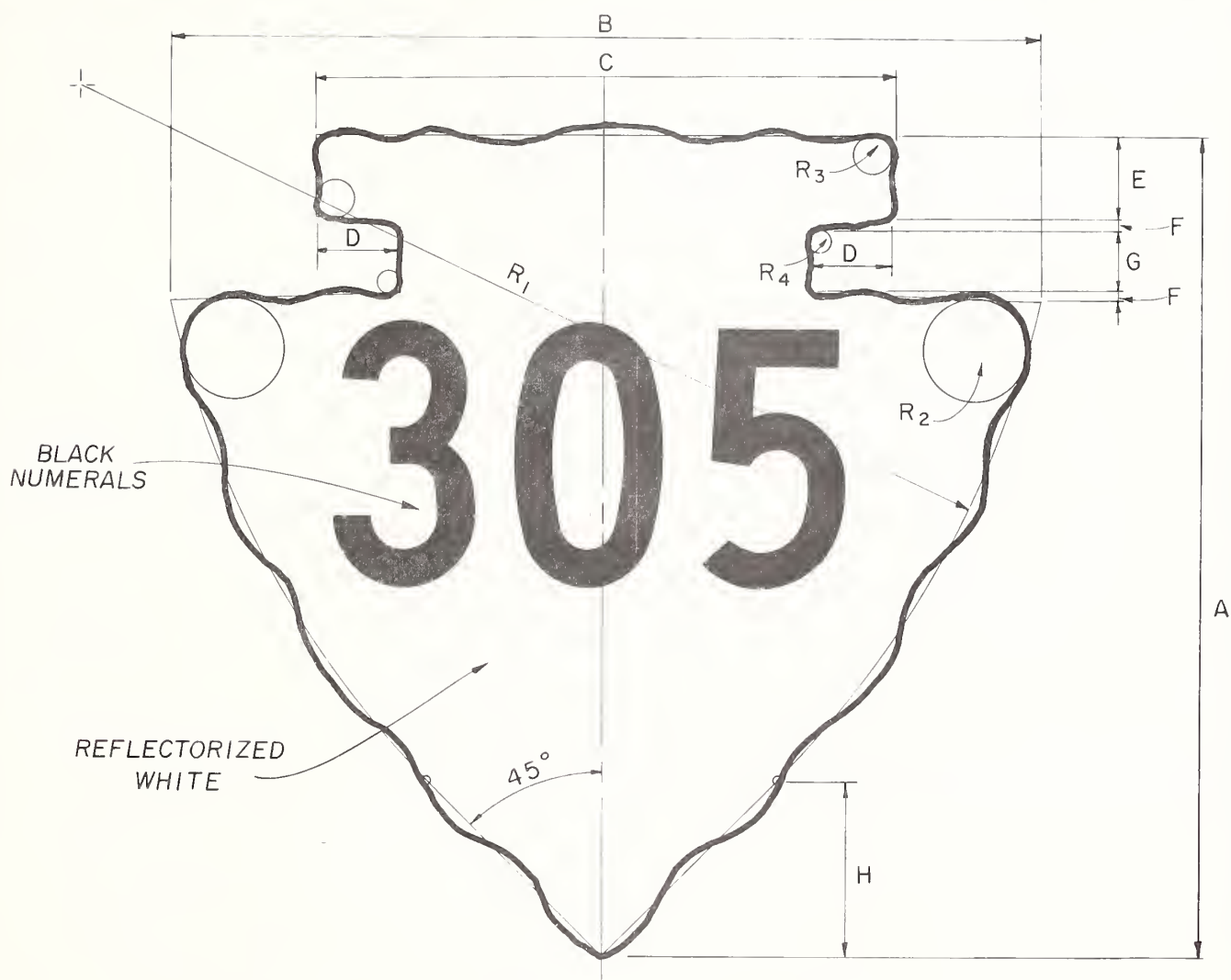
Revised 3-1-67 9-1-70
Effective 6-1-67 1-1-71

STANDARD DRAWING NO. 88-28

State Highway Commission
Helena, Montana

SECONDARY ROUTE MARKER FOR USE ON GUIDE SIGNS

Approved
James M. Sullivan
Act. State Highway Engineer

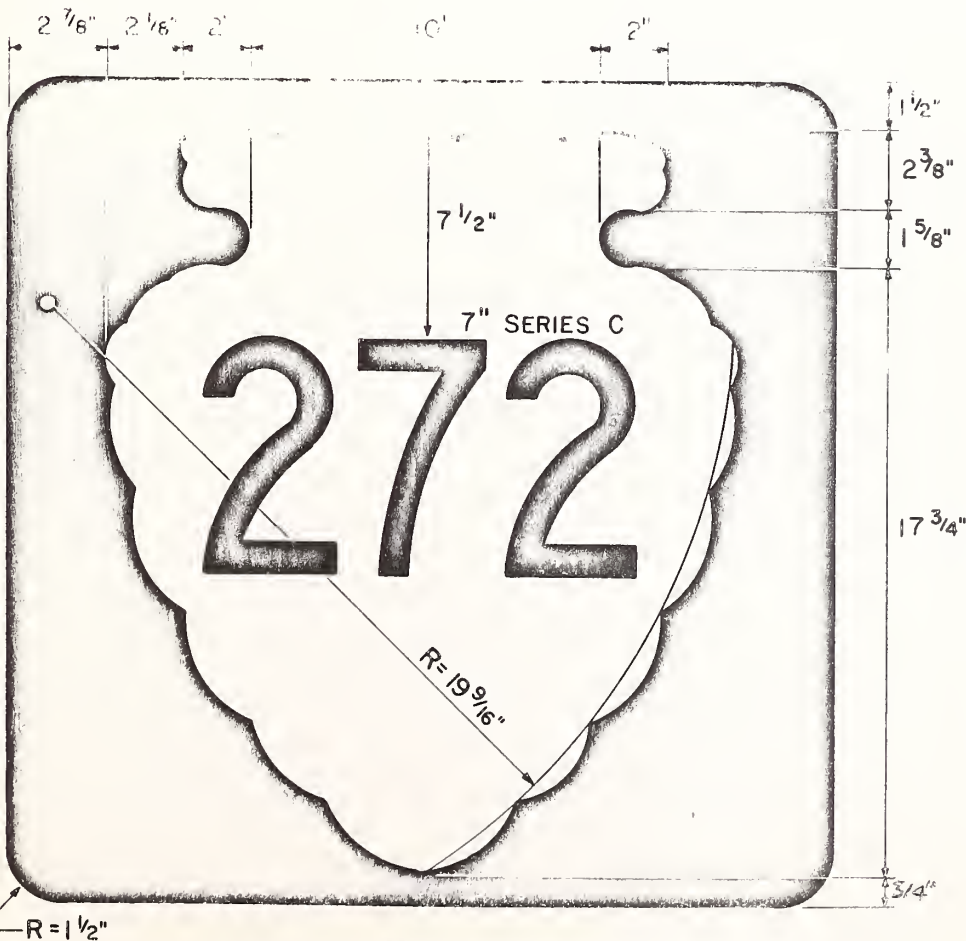
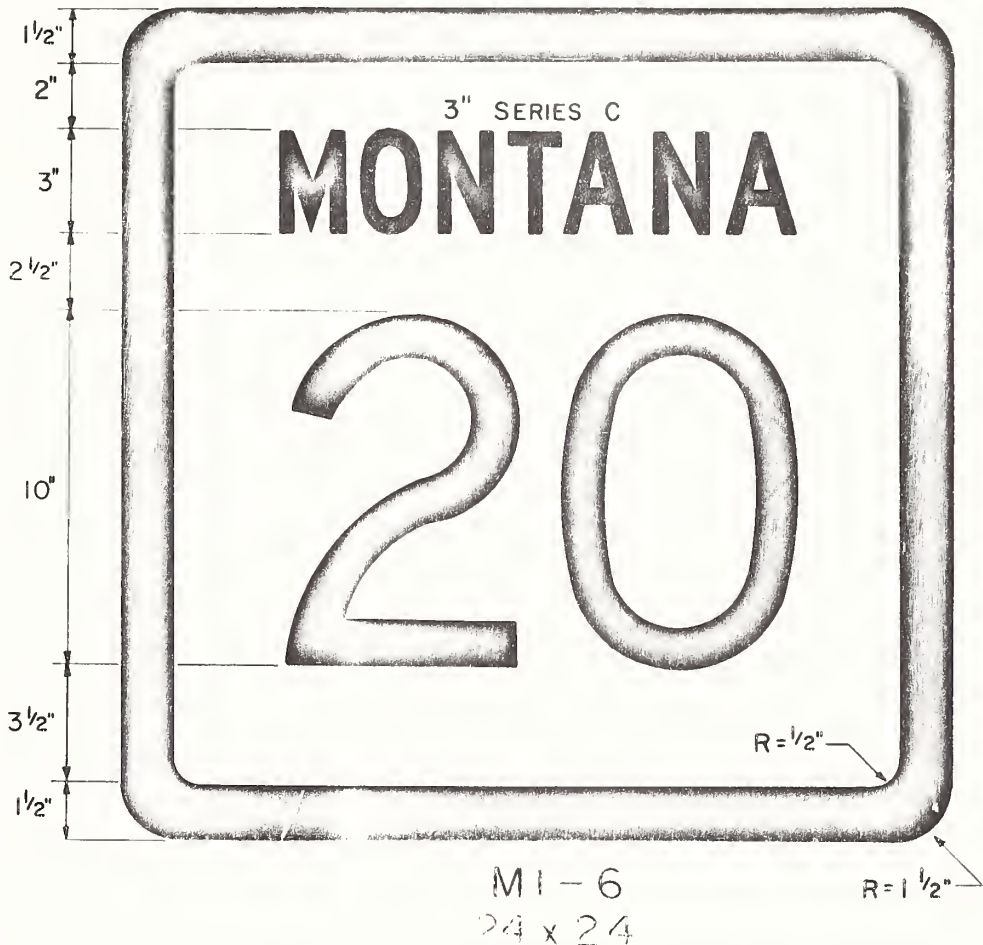


SHIELD DIMENSIONS IN INCHES

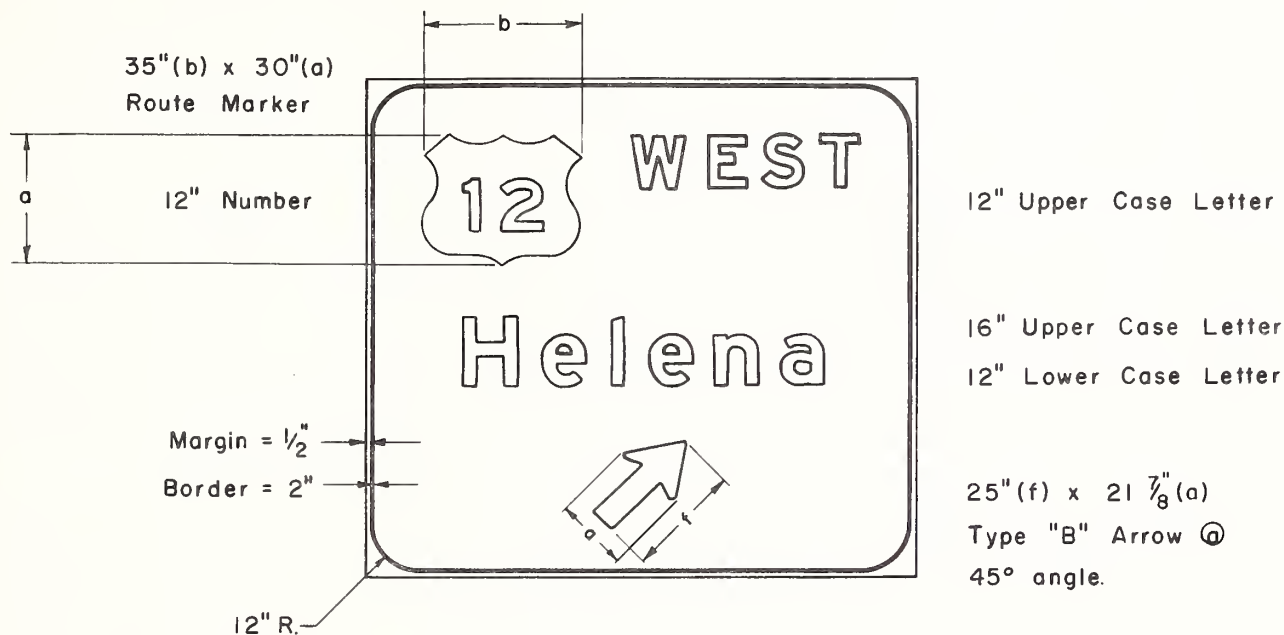
	NUMERAL SIZE	A	B	C	D	E	F	G	H	R ₁	R ₂	R ₃	R ₄
*	8" C	26	28	18 1/2	2 5/8	3	5/16	2	5 1/2	32	1 3/4	5/8	5/16
**	10" C	32	34	22 1/2	3 1/4	3 5/8	3/8	2 1/2	6 3/4	38 1/2	2	3/4	3/8
***	12" C	40	42	28	4	4 1/2	1/2	3	8 7/16	48	2 1/2	1	1/2

- * TO BE USED WITH STANDARD 24" U. S. SHIELD
- ** TO BE USED WITH STANDARD 30" & 36" U. S. SHIELD
- *** TO BE USED WITH STANDARD 42" U. S. SHIELD & ALL INDEPENDENT USE

- 1 DIGIT - 10" SERIES 'E'
- 2 DIGITS - 10" SERIES 'D'
- 3 DIGITS - 10" SERIES 'C'



NOTE:
BLACK LEGEND ON
REFLECTORIZED WHITE
BACKGROUND.



Dimensions shown are typical only; see plans for actual sizes

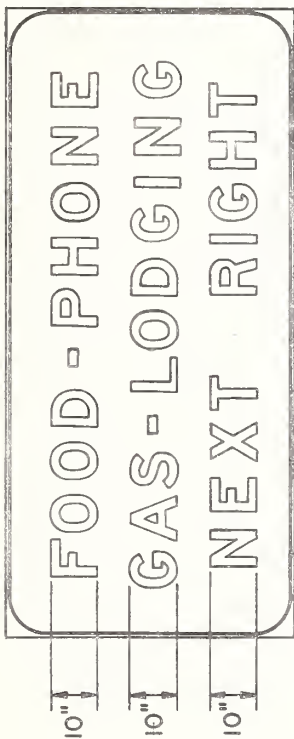
SIGN DESIGN SPECIFICATIONS

Smaller Dimension of Sign	Corner Radius
0'-0" TO 2'-6"	3"
3'-0" TO 4'-6"	6"
5'-0" TO 6'-6"	9"
7'-0" & Greater	12"

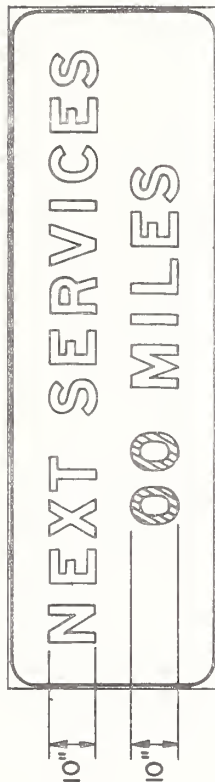
Largest Letter on Sign	Margin	Border
8" Letters or Less	1/2"	1"
Greater Than 8"	1/2"	2"

NOTES

1. All Interstate and U.S. Route Markers, and all Arrows used on Guide Signs must conform to those shown in the AASHO "Manual for Signing and Pavement Markings," 1961 Interstate Edition.
2. All State Route Markers must conform to those shown in Standard Drawings 88-27 & 88-28.
3. Guide Signs shall have white legend and border on an Interstate Green background. Legend, border, and background shall be reflectorized.
4. Series "E" Letters in Type "A" or "B" demountable legend shall be used unless otherwise specified. Legends eight inches or less may be either demountable or direct applied cutout letters.
5. Signs to be overlaid shall have Type "C" direct applied cutout legend and border.



I-1a
12'-0" X 5'-6"



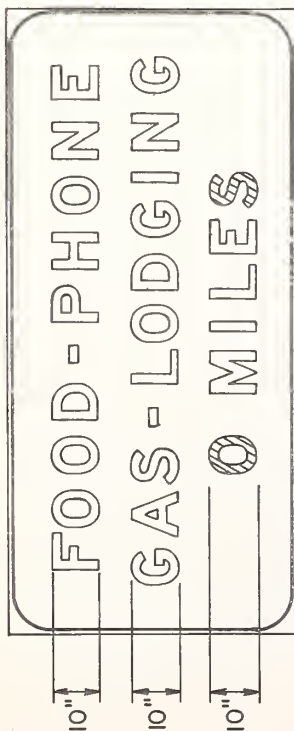
I-6
13'-0" X 4'-0"



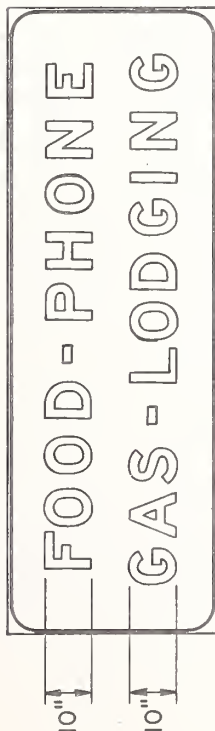
I-8
7'-0" X 1'-6" or 9'-0" X 2'-0"

NOTES:

- I-1, I-1a & I-2; If any one of the services is not available the space it normally occupies is to be left blank. See plan sheets for services to be shown.
- I-8; Legend size varies according to sign location. Service guide signs shall have white legend and border on a Interstate Blue background. Legend, border and background shall be reflectorized. Type A or B removable copy shall be used. (See Standard Specifications)



I-1
12'-0" X 5'-6"



I-2
12'-0" X 4'-0"



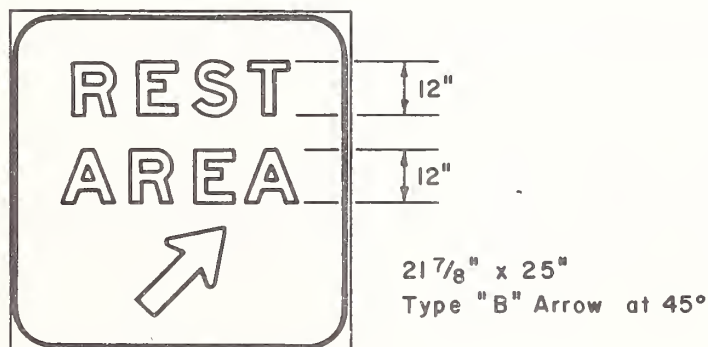
I-7
12'-0" X 8'-0"



I - 3
12' - 0" x 5' - 0"



I - 4
12' - 0" x 5' - 0"

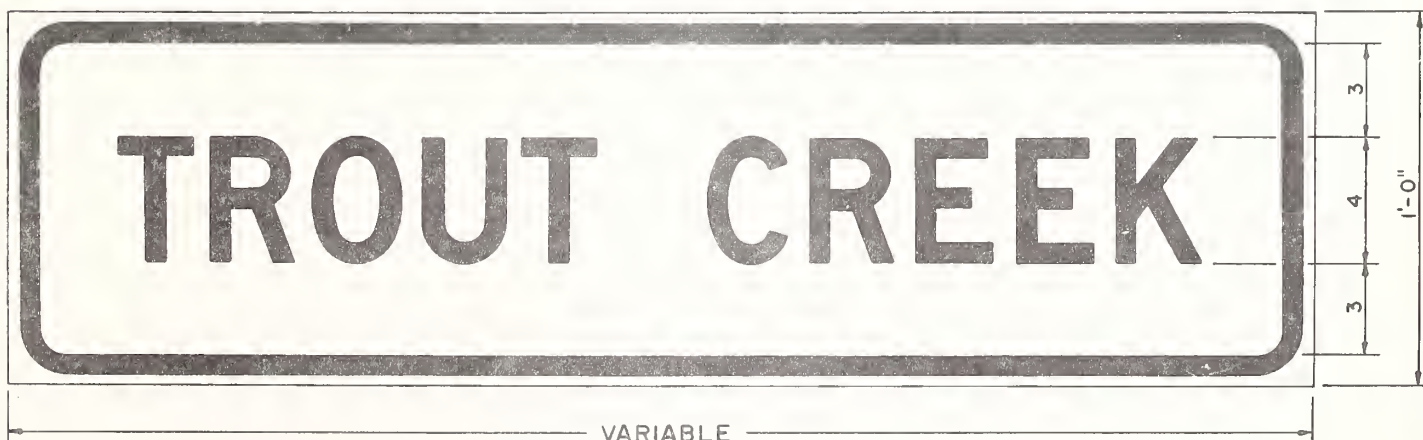
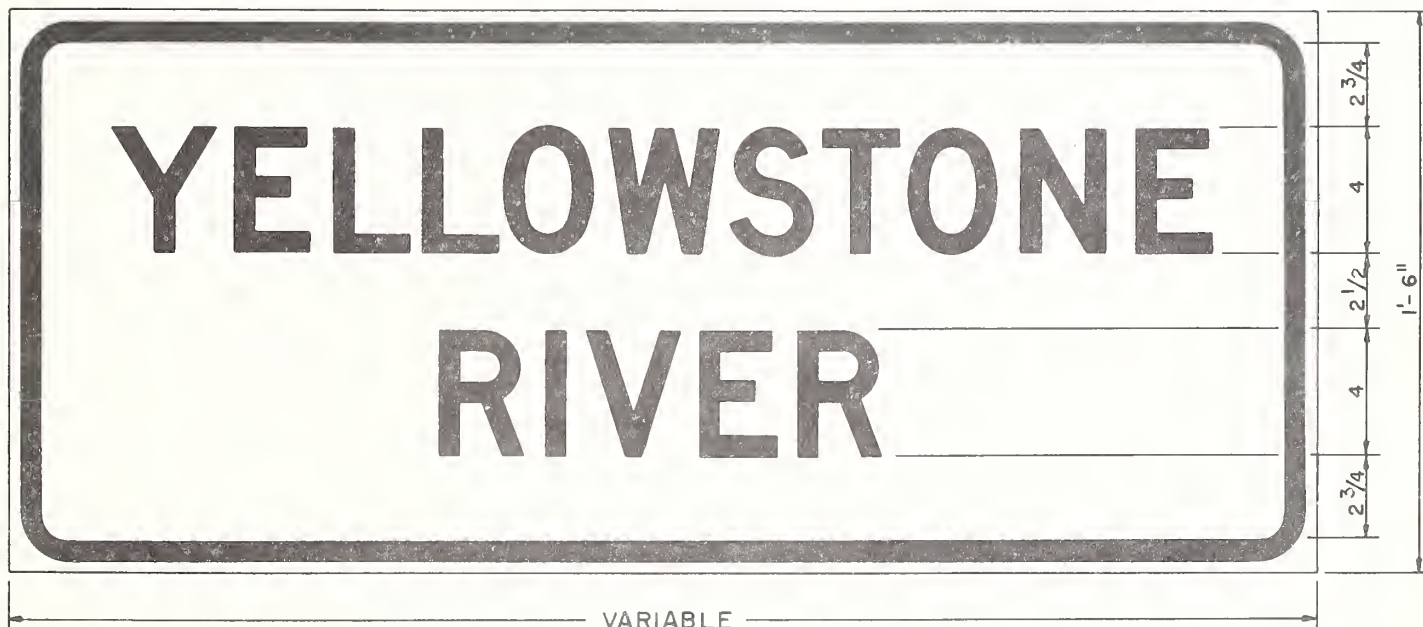


I - 5
6' - 6" x 6' - 6"

NOTES:

Informational guide signs shall have white legend and border on a Interstate Blue background. Legend, border and background shall be reflectorized. Type A or B removable copy shall be used. (See Standard Specifications)

Drawn <u>Oct. 1, 1964</u>	REVISED <u>9-1-70</u>	STANDARD DRAWING NO. <u>88-38</u>
State Highway Commission Helena, Montana	EFFECTIVE <u>1-1-71</u>	Approved <i>[Signature]</i> State Highway Engineer
STANDARD N6-2 STREAM NAME SIGN PRIMARY & SECONDARY ROUTES		



NOTES:

1. SIGN SIZE VARIES WITH LEGEND.
2. SIGNS OVER 36" WIDE SHALL HAVE 2" x 4" BACK BRACES.
3. SIGN FACE & LEGEND:
 - REFLECTORIZED GREEN BACKGROUND.
 - 4" SERIES 'D' REFLECTORIZED WHITE LETTERS.
 - 3/8" MARGIN.
 - 5/8" REFLECTORIZED WHITE BORDER.
 - 1 1/2" CORNER RADII.

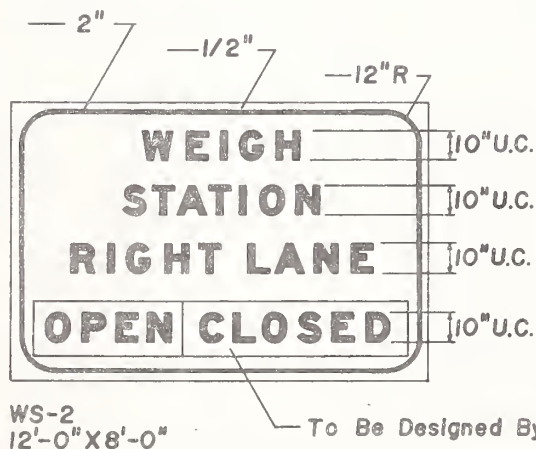
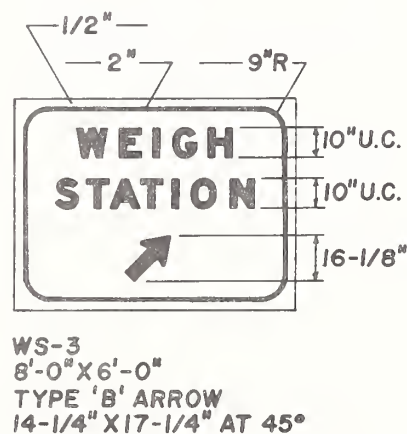
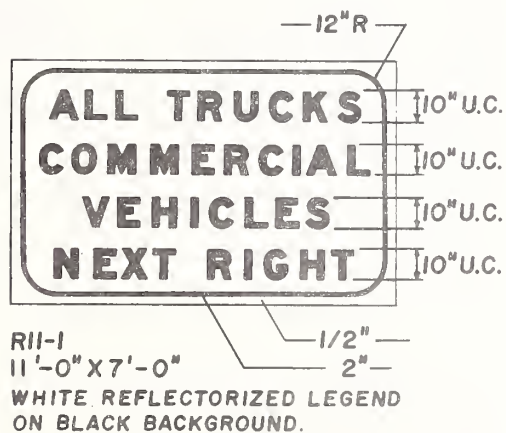
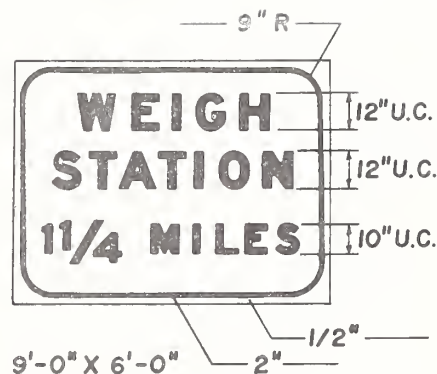
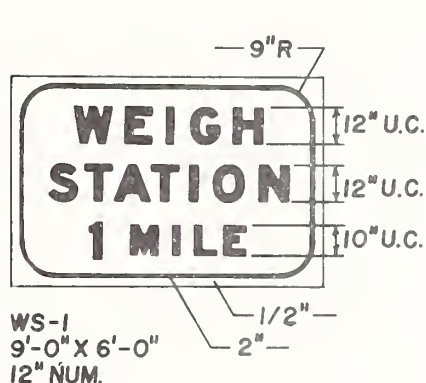
State Highway Commission
Helena, Montana

WEIGH STATION SIGNS

Approved
State Highway Engineer

NOTE

WEIGH STATION GUIDE SIGNS SHALL HAVE WHITE LEGEND AND BORDER ON INTERSTATE GREEN BACKGROUND. LEGEND, BORDER, AND BACKGROUND SHALL BE REFLECTORIZED. TYPE A, B REMOVABLE COPY SHALL BE USED. (SEE STANDARD SPECIFICATIONS).

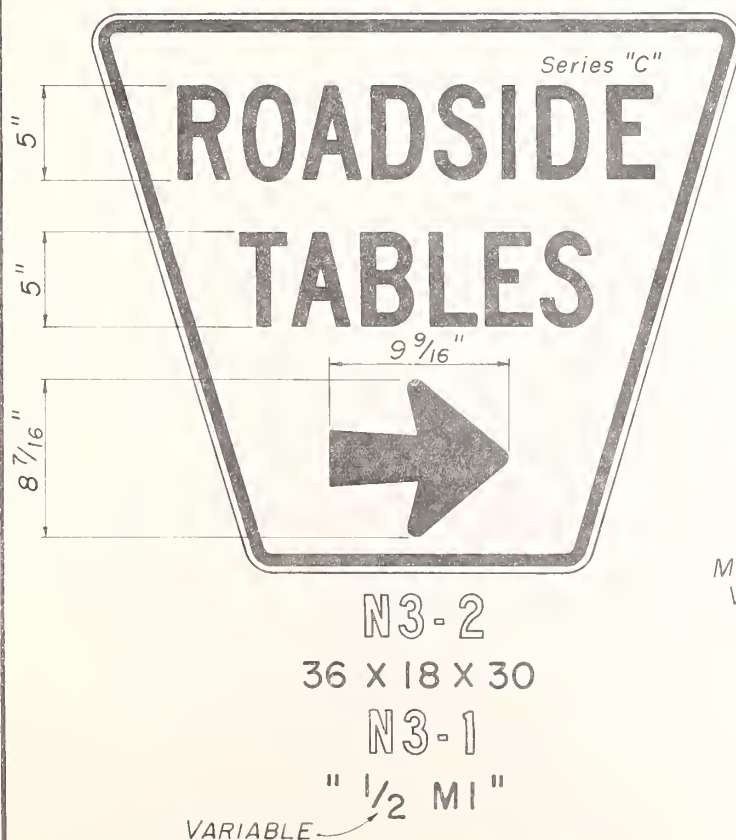
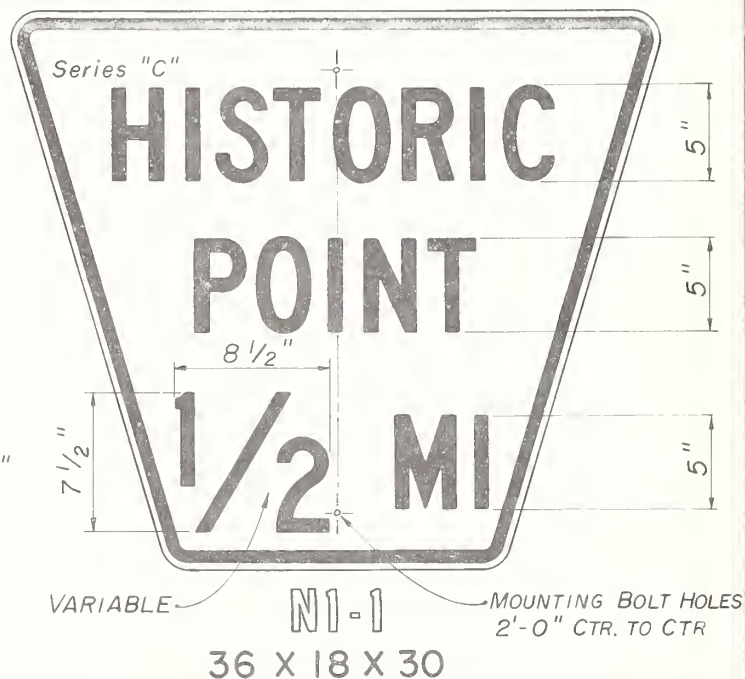
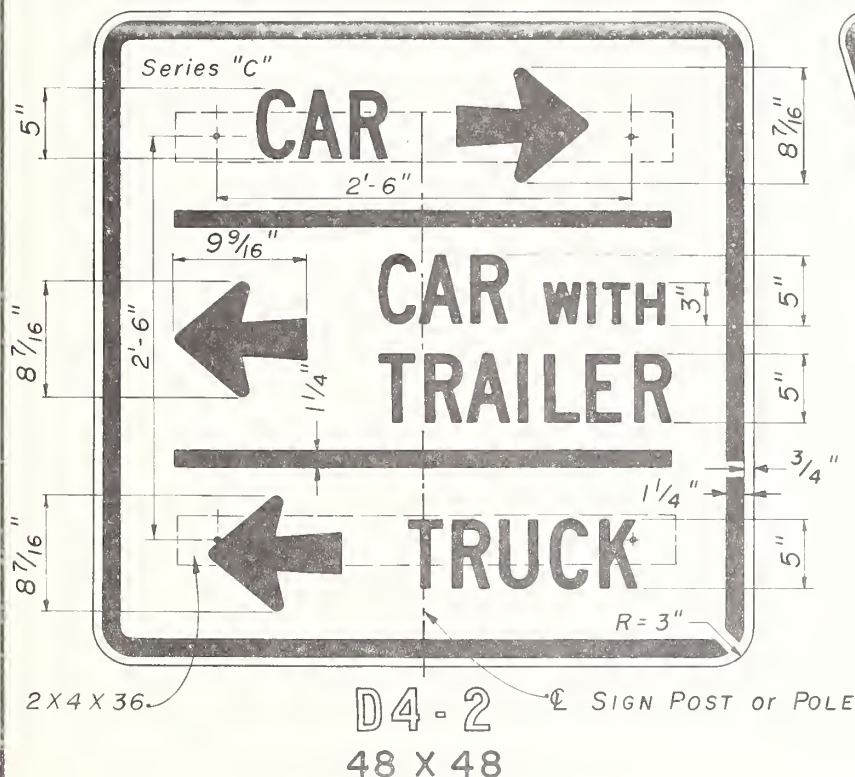


To Be Designed By Electrical Dept.

STANDARD REST AREA & INFORMATION SIGNS

NOTES:

1. ALL SIGNS ON THIS PAGE SHALL HAVE GREEN
LEGEND AND BORDERS ON A WHITE REFLECTORIZED
BACKGROUND.
2. ALL DIRECTIONAL ARROWS SHALL BE THE INTER-
STATE TYPE "B" ARROW, 9 $\frac{9}{16}$ " X 8 $\frac{7}{16}$ ".
3. SEE D4-2 & N7-1 FOR TYPICAL SIGN PANEL
DETAILS. (BORDER, MARGIN, ETC.)
4. SIGNS ON THIS PAGE ARE TYPICAL
SIGNS. SEE PLAN SHEETS FOR ACTUAL
SIGN LAYOUTS.



Drawn 6-1-65

REVISED 11-1-68
EFFECTIVE 1-1-69

STANDARD DRAWING NO. 88-48

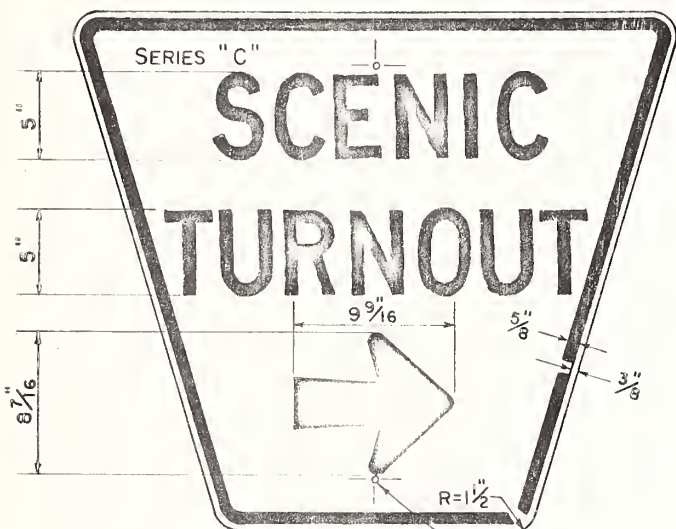
State Highway Commission
Helena, Montana

INFORMATION SIGNS

Approved
James R. Galt
State Highway Engineer

NOTES:

1. ALL SIGNS ON THIS PAGE SHALL HAVE GREEN LEGEND AND BORDERS ON A WHITE REFLECTORIZED BACKGROUND.
2. ALL DIRECTIONAL ARROWS SHALL BE THE INTER-STATE TYPE "B" ARROW, $9\frac{9}{16}$ " X $8\frac{7}{16}$ ".
3. SEE ALSO STD. DWG. NO. 88-47



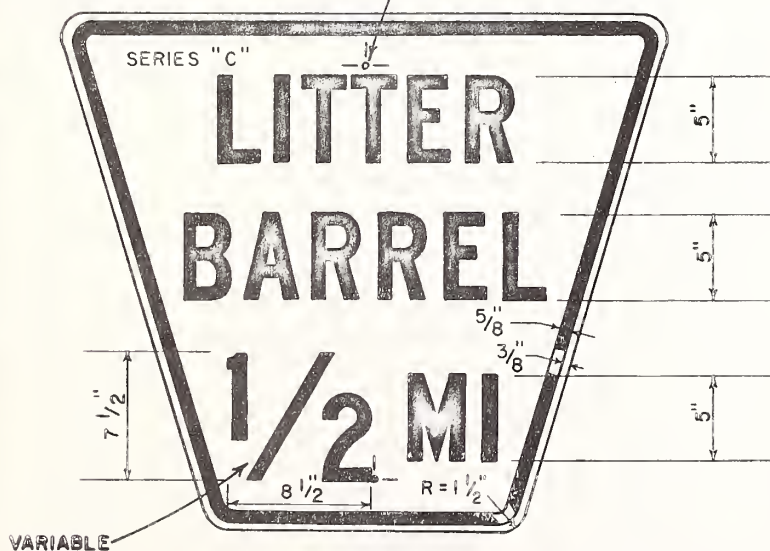
N8-2
36 X 18 X 30

MOUNTING BOLT HOLES
2'-0" CTR. TO CTR.

N8-1

"1/2 MI"

VARIABLE



N9-1

36 X 18 X 30

N9-2

DIRECTIONAL ARROW

SEE ALSO STD. DWG. NO. 88-47

Drawn 6-1-65

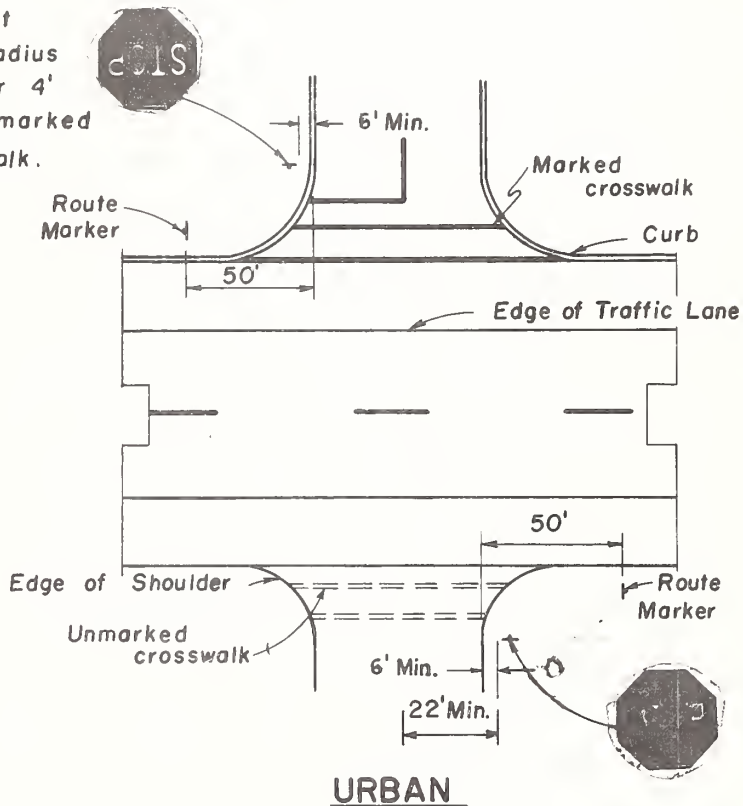
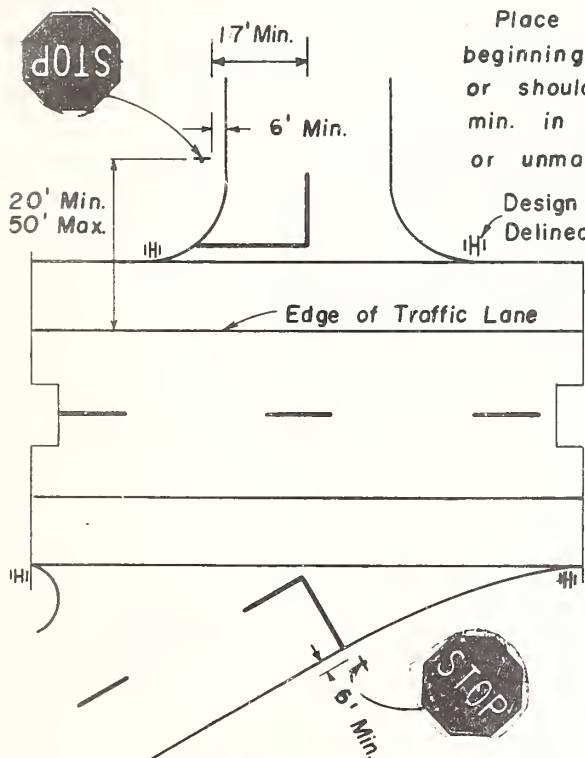
Revised 1-1-68 1-28-69 7-9-71
Effective 2-1-68 1-1-70 8-1-71

STANDARD DRAWING NO. 88-56

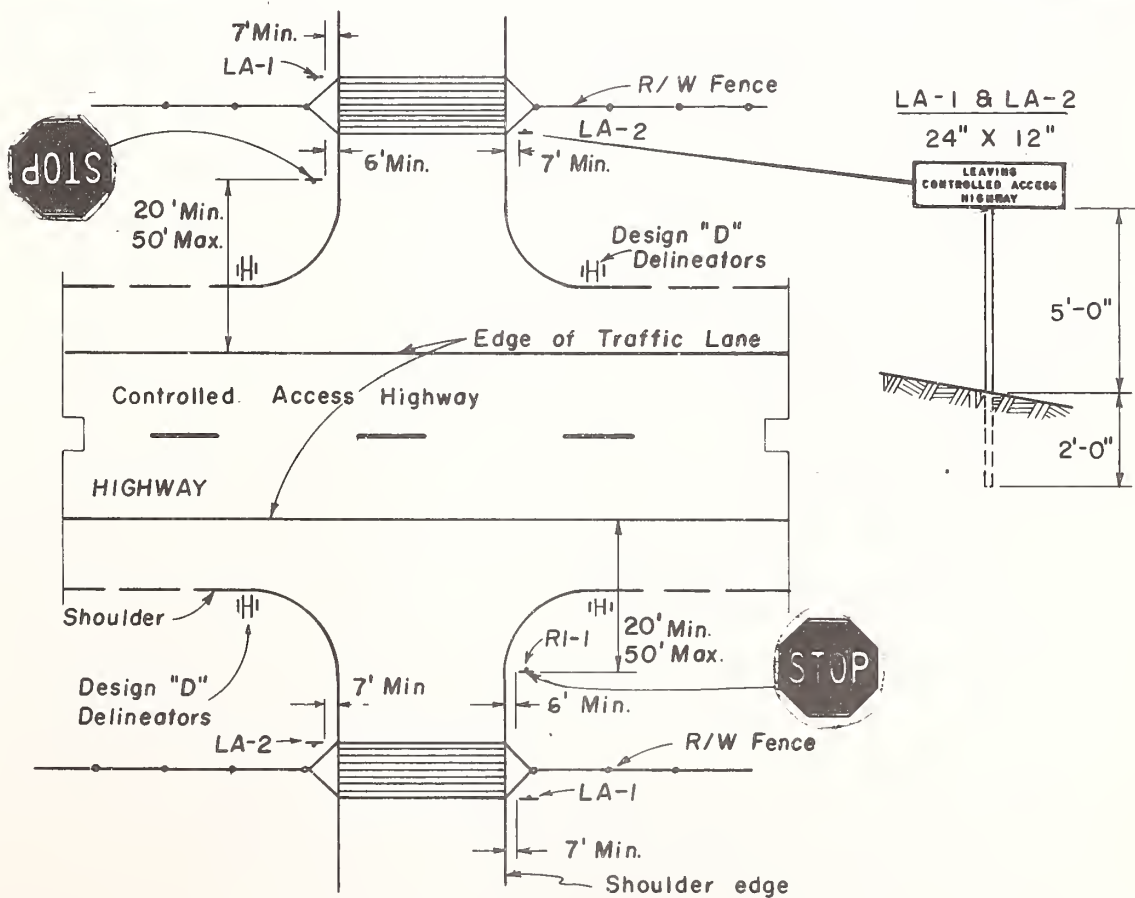
State Highway Commission
Helena, Montana

TYPICAL APPROACH ROAD SIGNING

Approved
James G. Phillips
State Highway Engineer



Note:
LA-1 & LA-2 Shall be mounted on galvanized steel U posts, 2 Lbs./Ft.



CONTROLLED ACCESS

Drawn 6-1-65

Revised 11-1-68 9-1-70 7-9-71
Effective 1-1-69 1-1-71 8-1-71

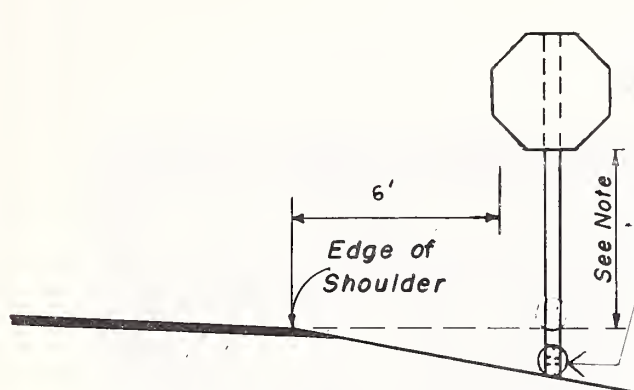
STANDARD DRAWING NO. 88-57

State Highway Commission
Helena, Montana

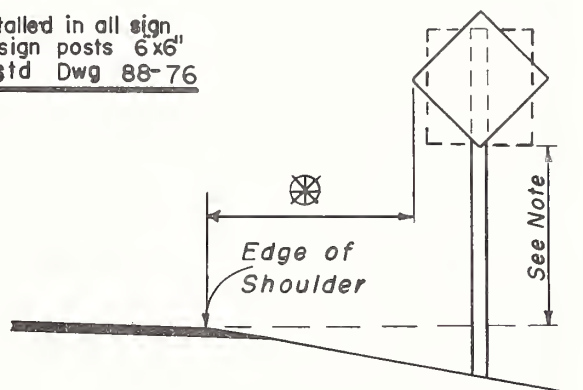
TYPICAL SIGN ERECTION

Approved
James A. Collins
State Highway Engineer

FOR REGULATORY & WARNING SIGNS



FOR ALL STOP SIGNS



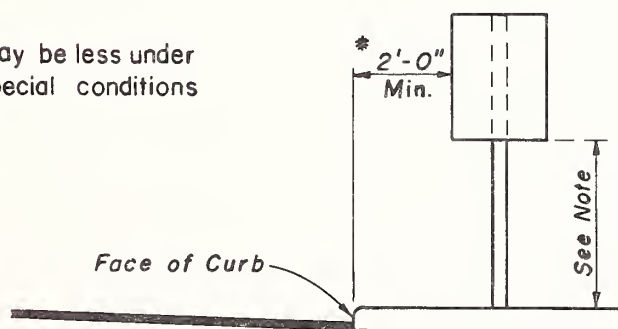
NOTE ÷ MOUNTING HEIGHTS

Rural _____ 5.0' Min.

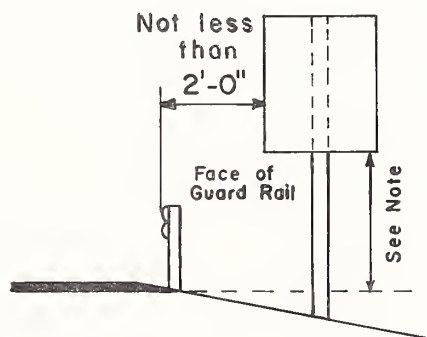
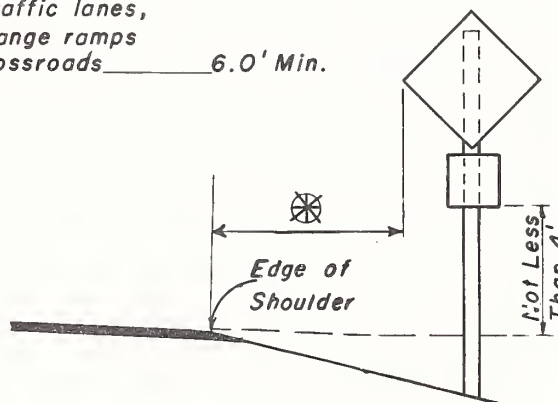
Urban _____ 7.0' Min.

Roads with Four or more traffic lanes,
Interchange ramps
and Crossroads _____ 6.0' Min.

* May be less under special conditions



FOR CURBED SECTION



FOR GUARD RAIL SECTION

NOTE:

SIGNS LESS THAN 10 SQ. FT. SHALL BE MOUNTED 10' FROM SHOULDER EDGE.

SIGNS GREATER THAN 10 SQ. FT. SHALL BE MOUNTED 20' FROM SHOULDER EDGE.

R5-4
36" X 24"

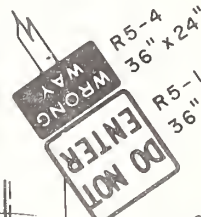
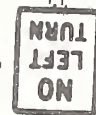


5/8" Border
2" Corner Radius

White legend on a red
reflectorized background

5"
5" Series F
4"
5" Series F
5"

R3-2
24" x 30"

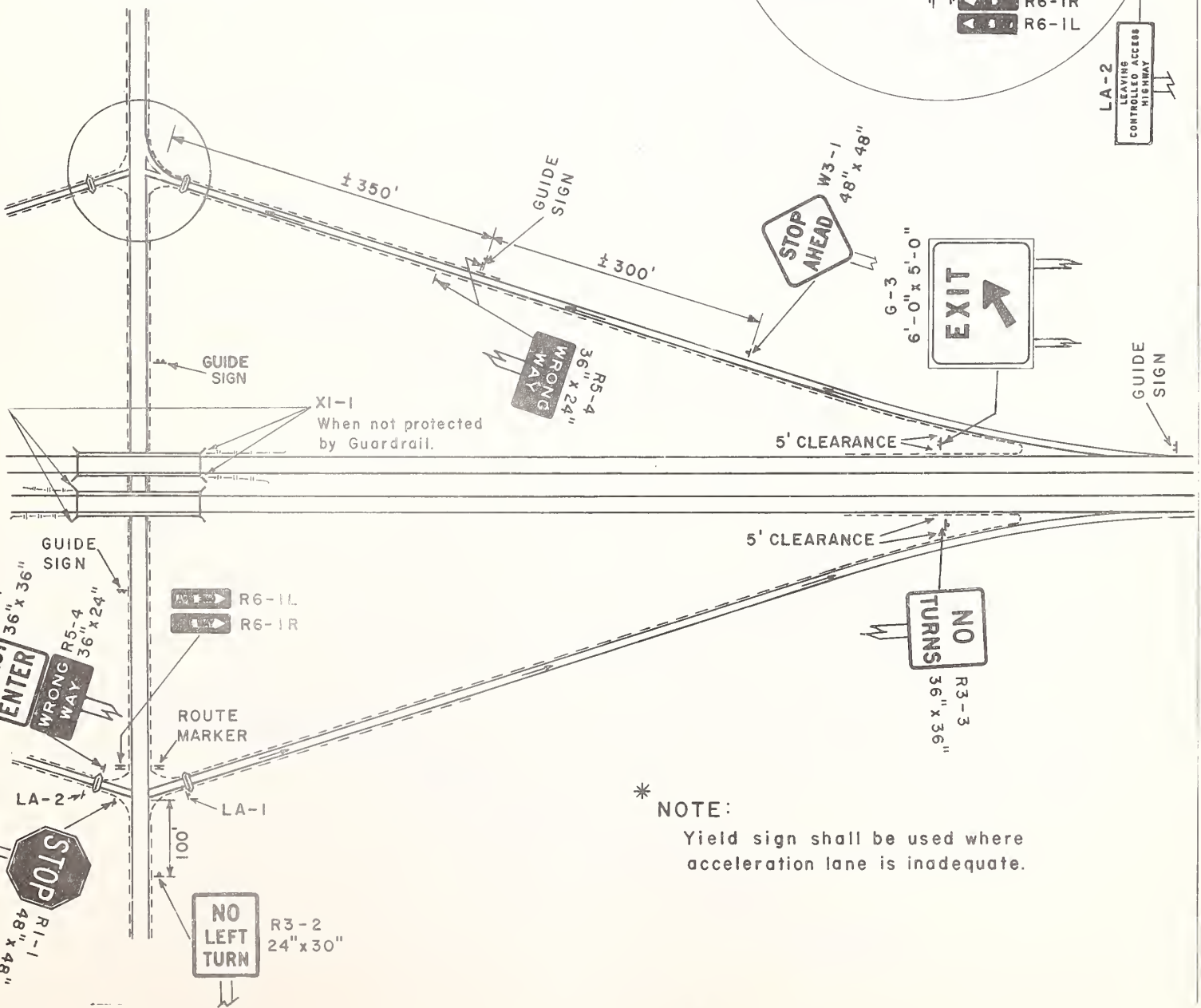


ENTERING
CONTROLLED ACCESS
HIGHWAY
LA-1

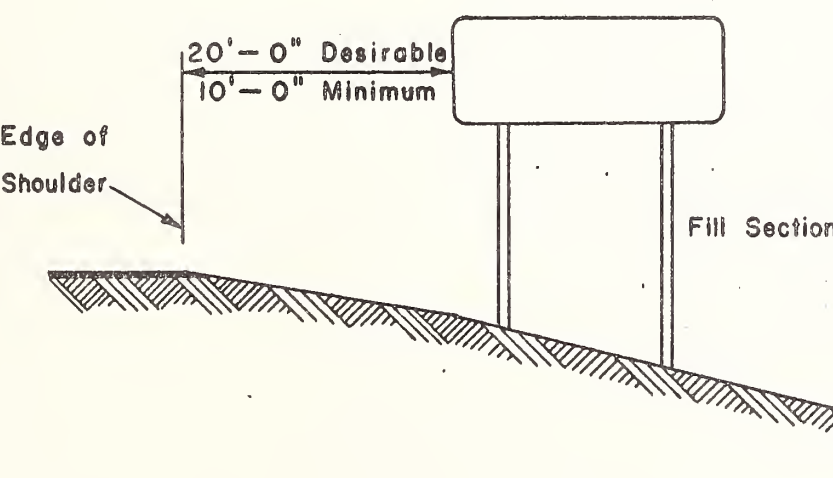
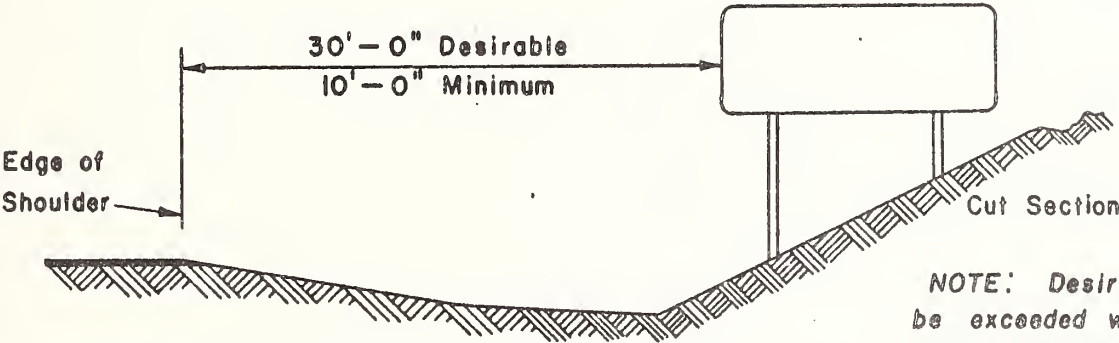
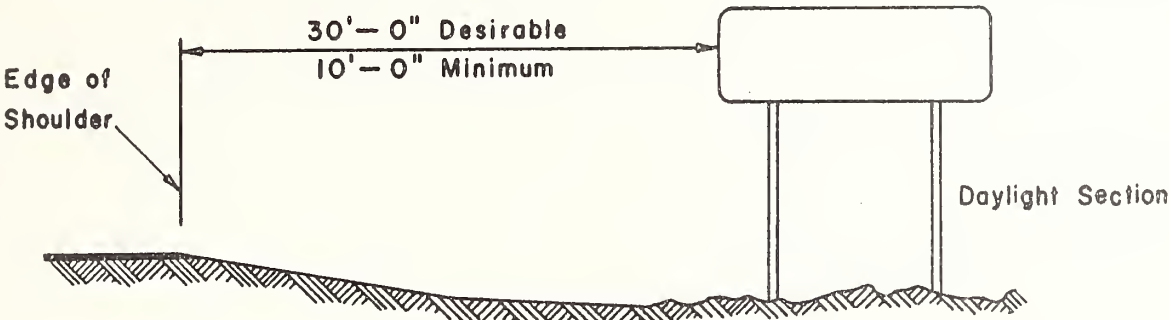
ROUTE
MARKER

R6-1R
R6-1L

LA-2
LEAVING
CONTROLLED ACCESS
HIGHWAY

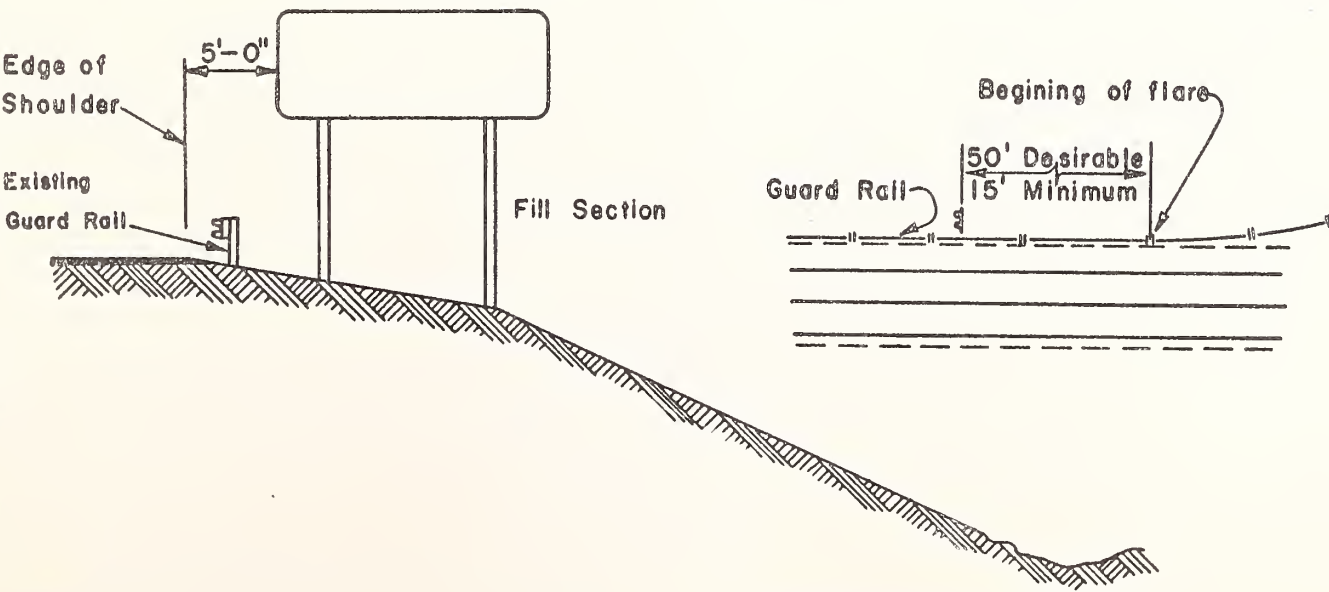


* NOTE:
Yield sign shall be used where
acceleration lane is inadequate.



NOTE: Desirable clearances may be exceeded when terrain and viewing conditions are favorable, such as, placement on a curve to the left. Clearances may be reduced when conditions are poor, such as, placement on a curve to the right. Maximum clearances shall be 45'-0".

For other Guide Sign specifications see Standard Drawing No. 88-67.

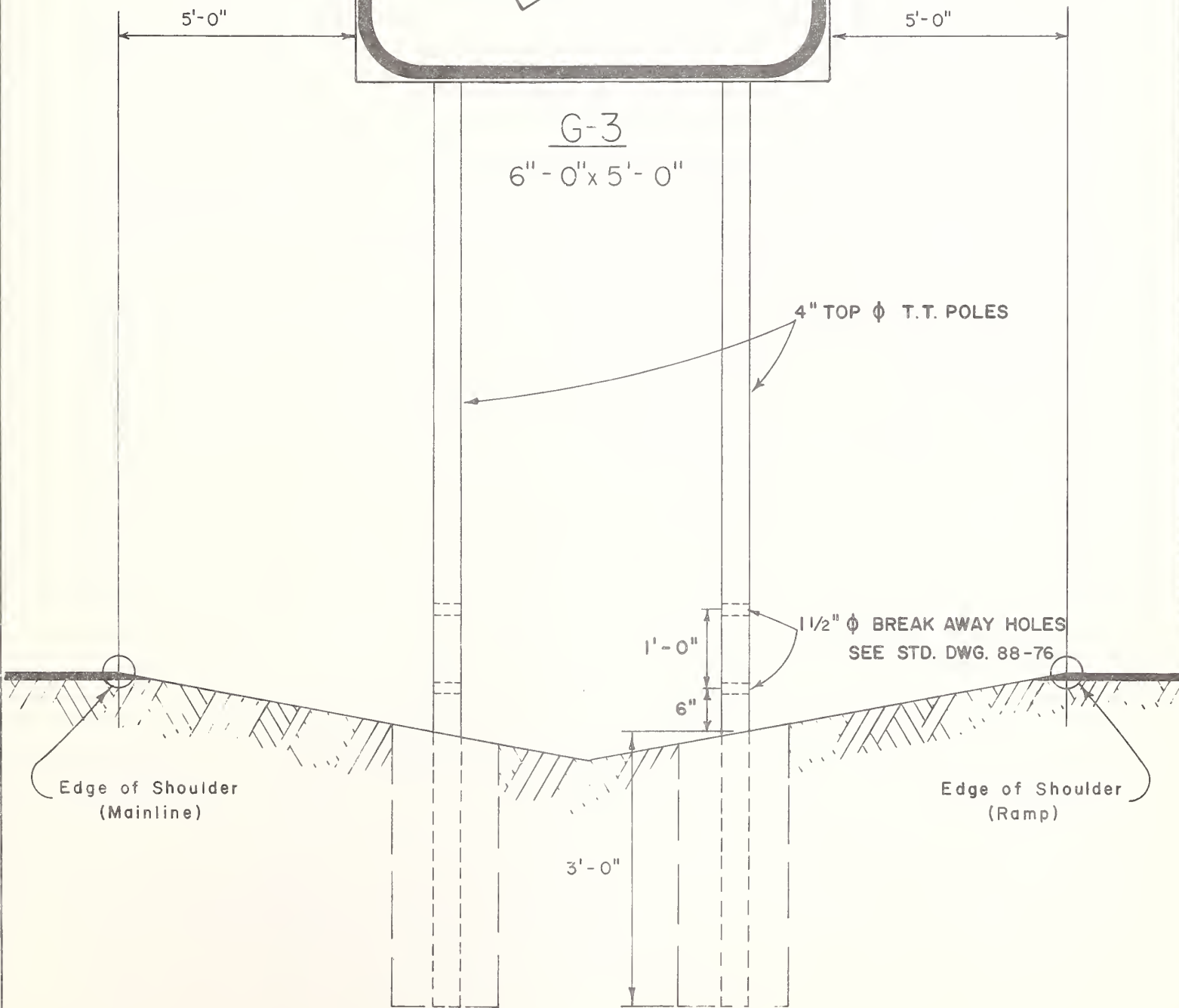


NOTE -
FOR DESIGN SPECIFICATIONS
SEE STANDARD DRAWING
NO 88-36



12" U. C.
SERIES E.

TYPE 'A' ARROW
29 1/4" x 18 1/4"
at 30° ANGLE



Drawn 6-1-65

Revised 7-1-68
Effective 1-1-69

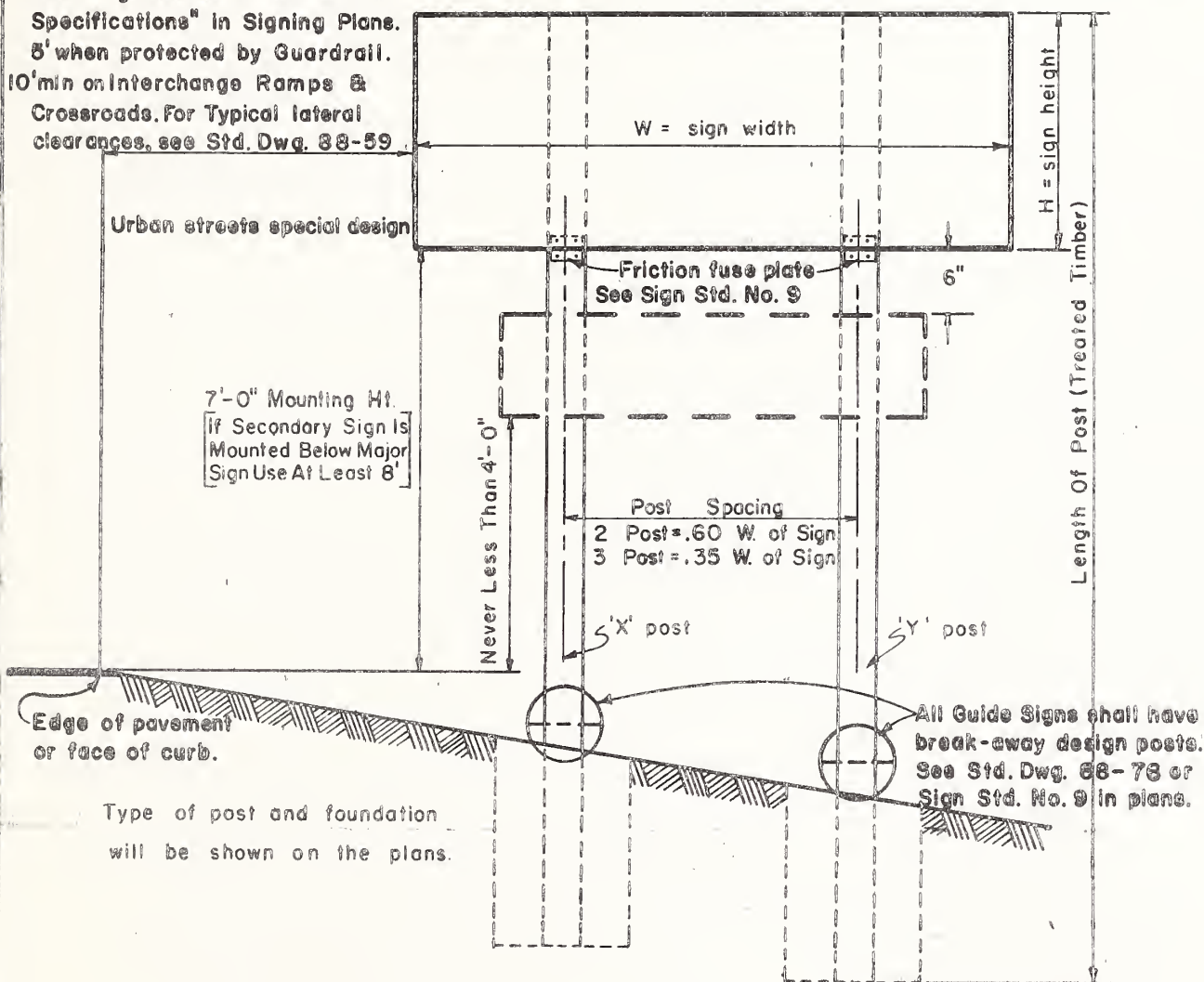
STANDARD DRAWING NO. 88-67

State Highway Commission
Helena, Montana

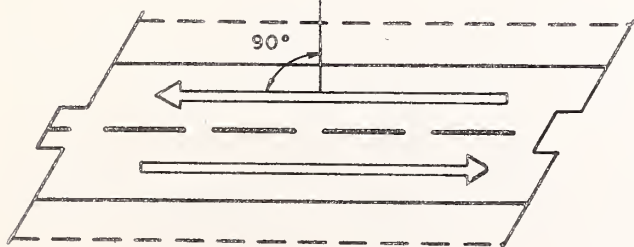
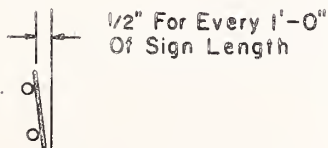
GUIDE SIGN PLACEMENT

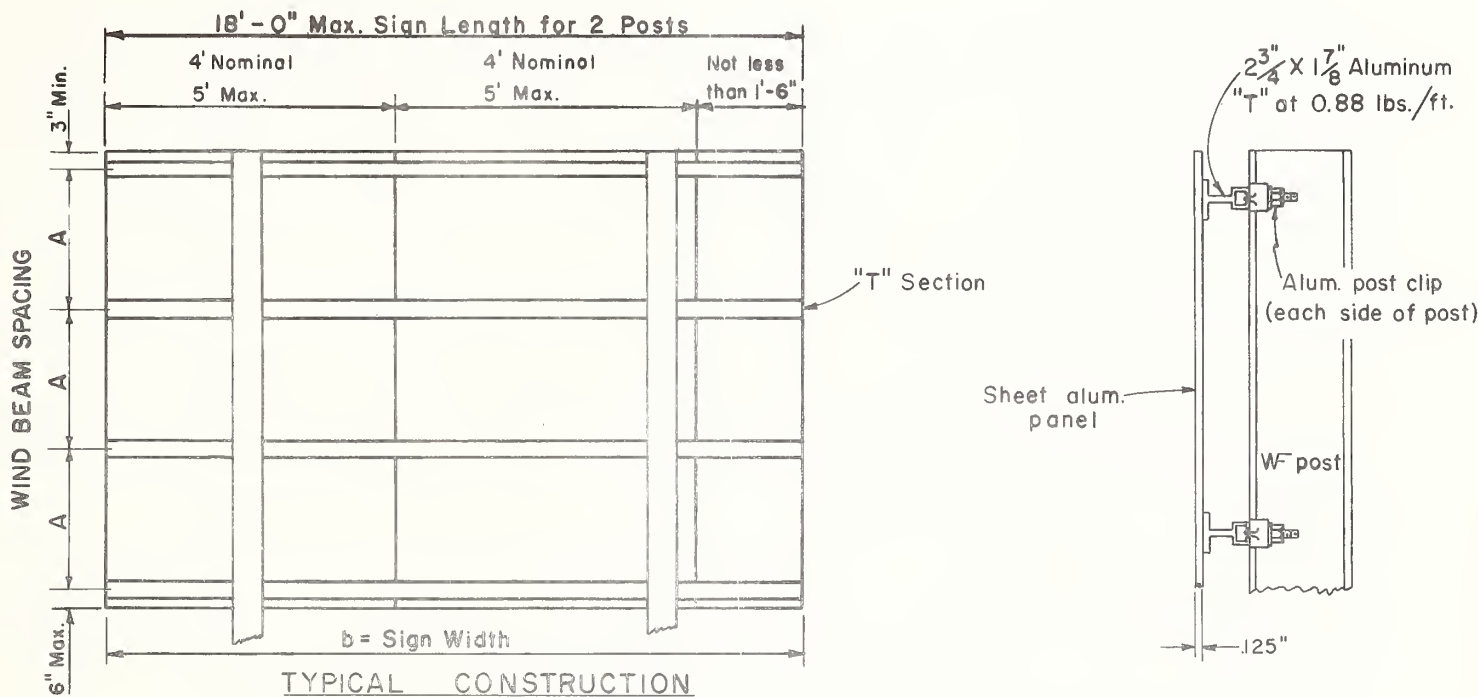
Approved
James M. Chilton 12-5-67
State Highway Engineer

See "Sign Location & Erection Specifications" in Signing Plans.
5' when protected by Guardrail.
10' min on Interchange Ramps & Crossroads. For Typical lateral clearances, see Std. Dwg. 88-59.



To avoid glare
turn sign away
from roadway.





NOTE:

Signs less than 4'-0" high and 8'-0" long will be made of a single sheet of aluminum.

Signs up to, and including, 8'-0" high will have no horizontal joints and no sheet shall be less than 1'-6" wide.

Signs over 8'-0" high may have horizontal and verticle joints, however no sheet shall be less than 1'-6" wide or 1'-6" high.

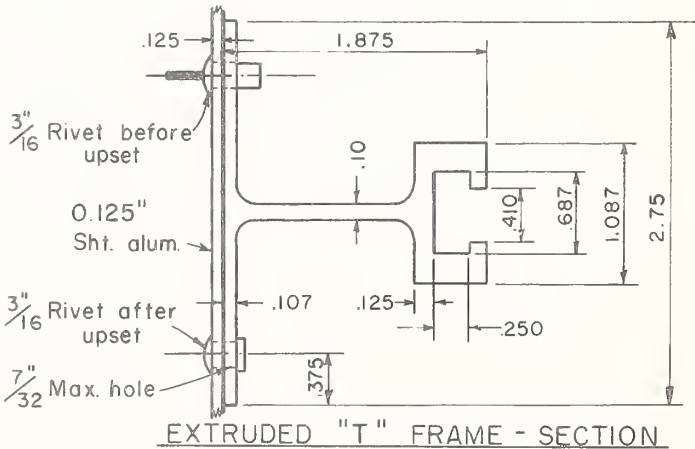
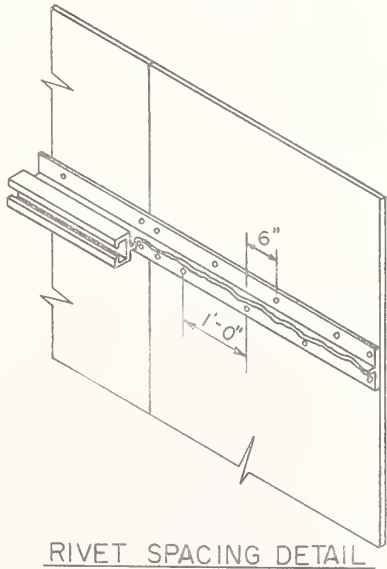
Tighten post clip nuts to 225 ⁱⁿ/_{lbs} torque using dry, clean threads.

No splices are allowed in extruded "T" sections.

All horizontal joints must occur at "T" sections.

All sheet aluminum shall be 0.125 thick.

Short width panels shall be placed on inside edge next to shoulder.



WIND BEAM CHART						
WIND BEAM SPA. "A"	b MAX.		.20b MAX.	.15b MAX.	.60b MAX.	.35b MAX.
	2 POST	3 POST	2 POST	3 POST	2 POST	3 POST
1 - 8	18 - 0	27 - 0	3 - 7	4 - 1	10 - 10	9 - 5
1 - 10	17 - 0	25 - 8	3 - 5	3 - 10	10 - 2	9 - 0
2 - 0 MAX.	16 - 6	24 - 6	3 - 4	3 - 8	9 - 10	8 - 7

NOTE:

Rivets 6" apart staggered from one side to another on horizontal extruded frame section.

Rivets doubled (both sides of extruded frame) at horizontal and vertical joints in sheet aluminum face and at ends of extruded T-section.

Drawn 6-1-65

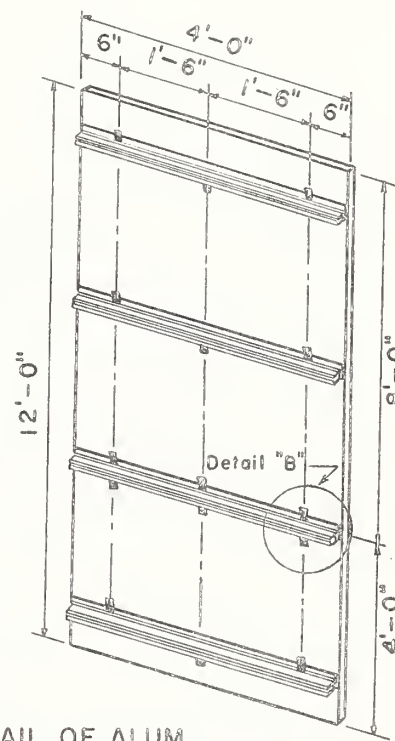
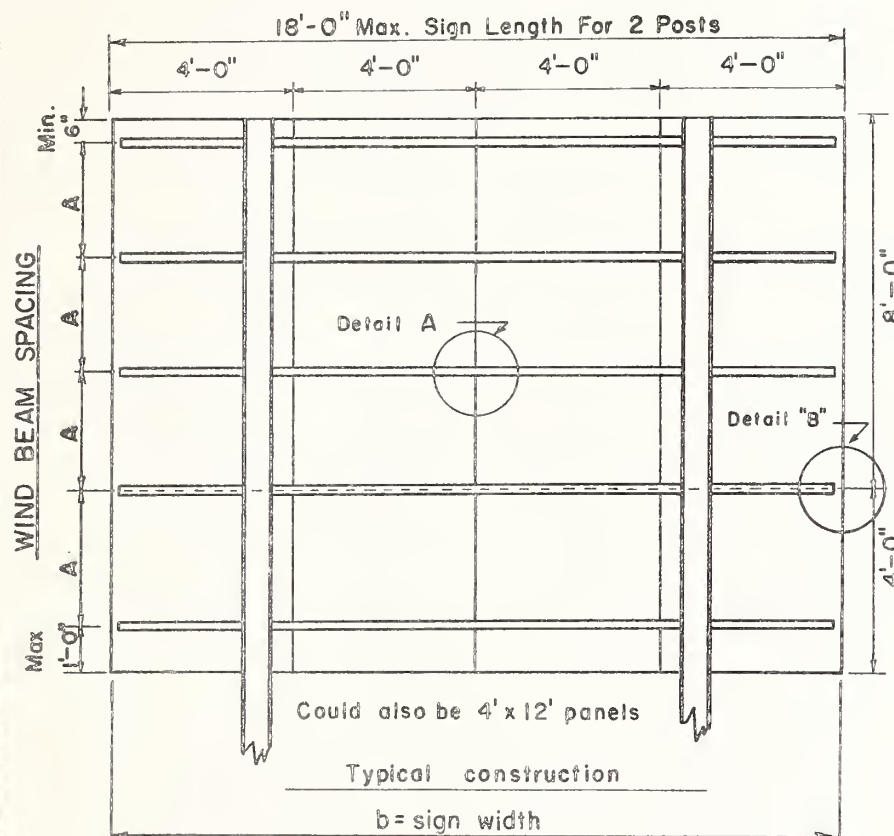
Revised 11-1-68
Effective 1-1-69

STANDARD DRAWING NO. 88-69

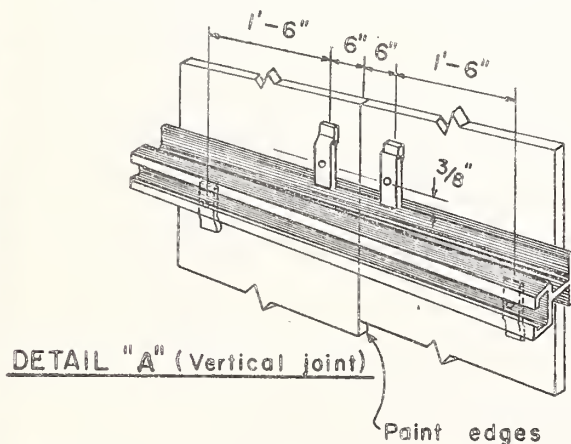
State Highway Commission
Helena, Montana

PLYWOOD SHEET INCREMENT GUIDE SIGN

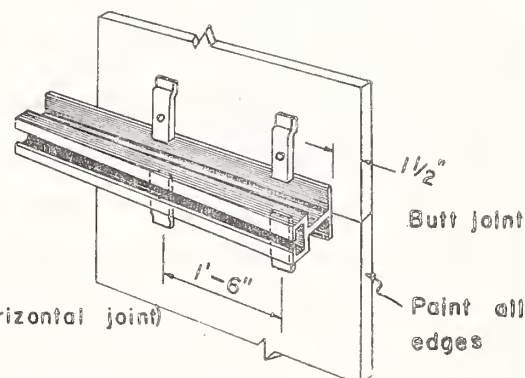
Approved
James H. Sullivan
State Highway Engineer



DETAIL OF ALUM.
CLIP PLACEMENT



DETAIL "B" (Horizontal joint)



Aluminum Sign Clip

1/4" Lockwasher

1/4" - 20 Mach. Bolt

All screws, bolts
and lockwashers
shall be Alum
Alloy, Stainless
Steel or Cadmium
Plated.

Alum. "T"

7/16" Alum. Sleeve Nut for 1/4" x 20 bolt
Put in place before applying
reflective sheeting.
Drill 5/16" ϕ hole.

DETAIL OF CLIP

WIND BEAM SPA. "A"	b		.20b		.15b		.60b		.35b	
	MAX.		MAX.		MAX.		MAX.		MAX.	
	2POST	3POST	2POST	3POST	2POST	3POST	2POST	3POST	2POST	3POST
1-6	18-0	27-0	3-7	4-1	10-10	9-5				
2-0	16-6	24-8	3-3	3-8	10-0	8-8				
2-6	14-9	22-0	3-0	3-4	8-9	7-8				
3-0	13-6	20-0	2-8	3-0	8-2	7-0				
3-6	12-6	18-6	2-6	2-9	7-6	6-6				

For signs 4'-0" high or greater, no panel shall be less than 4'-0" in height. Signs under 4'-0" high shall have no horizontal joints.

For signs with widths that are not multiples of 4 ft, place odd panel on the inside edge.

For signs over 10 ft. in height, the full height may be obtained with panels having a factory scarfed joint in lieu of using standard length panel as shown.

All horizontal joints must be at "T" section. The minimum size of an individual panel will be 1'-6" wide x 4'-0" high.

See Std. Dwg. No. 88-68 for extruded "T" section.

See Std. Dwg. No. 88-70 for post connection details.

Drawn 6-1-65

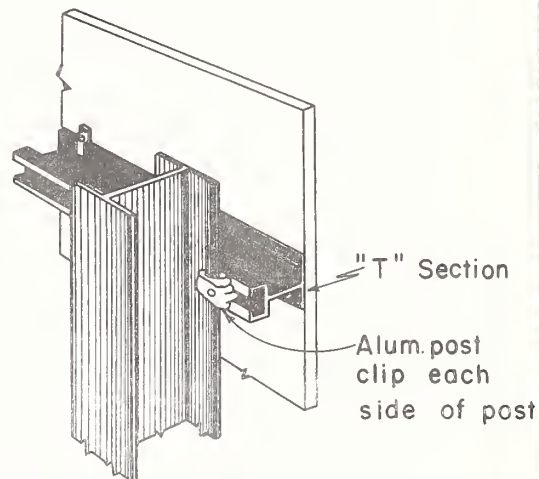
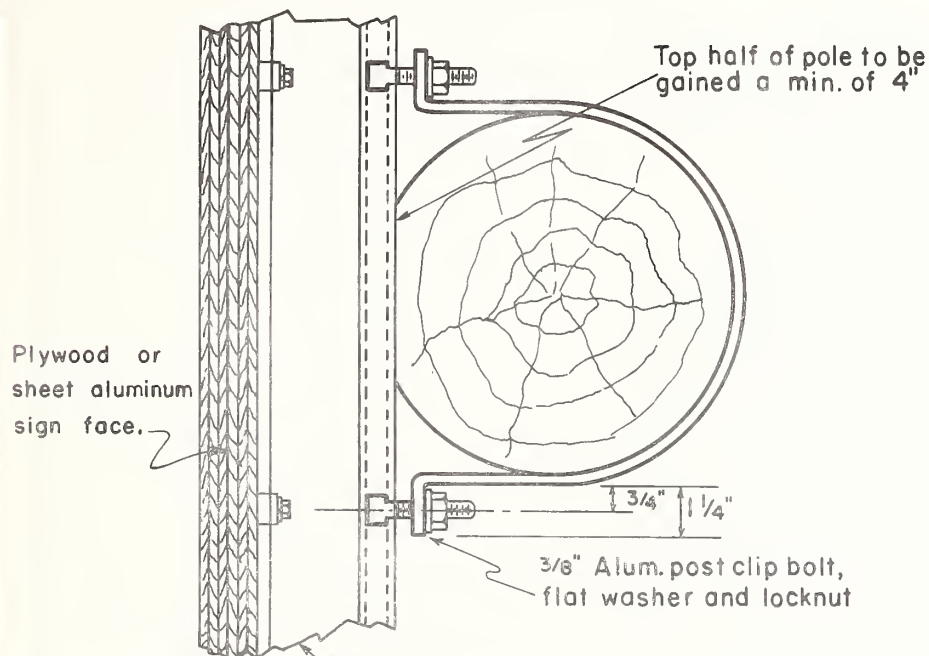
Revised 4-1-66 9-1-70
Effective 4-1-68 1-1-71

STANDARD DRAWING NO. 88-70

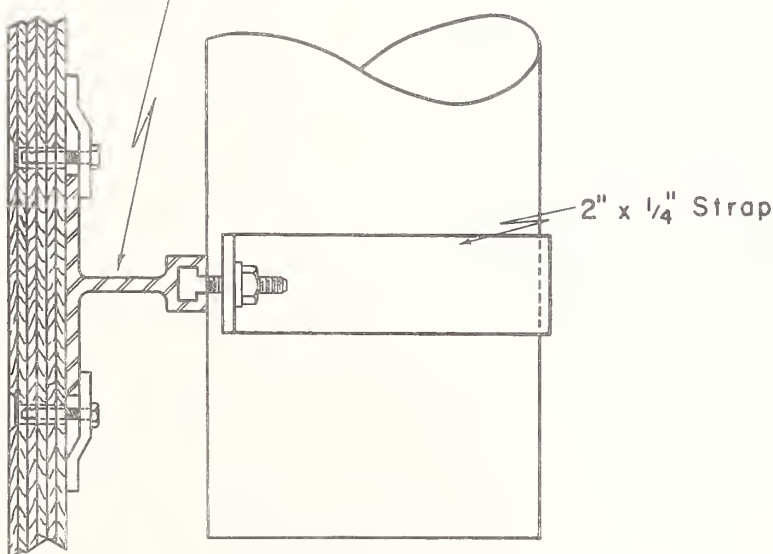
State Highway Commission
Helena, Montana

GUIDE SIGN MOUNTING DETAILS

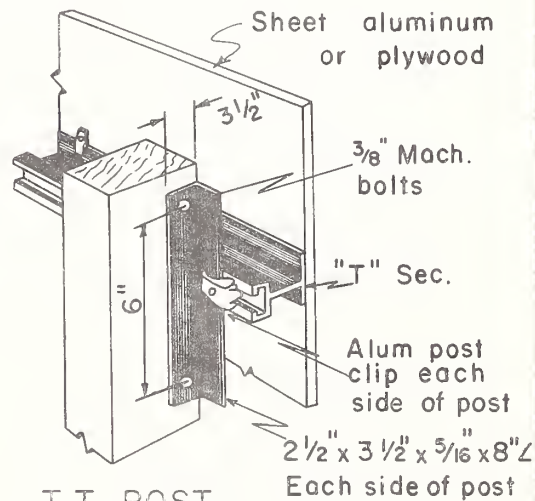
Approved
Lewis W. Phillips
State Highway Engineer



W POST



T.T. POLE



T.T. POST

NOTE:

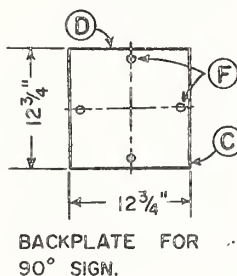
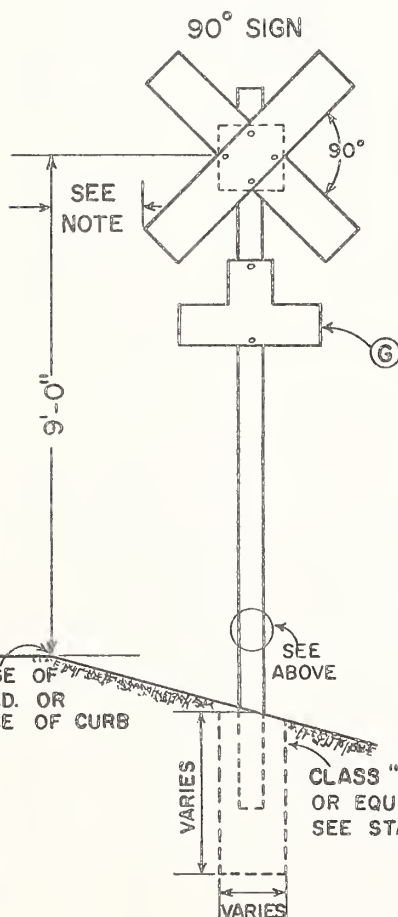
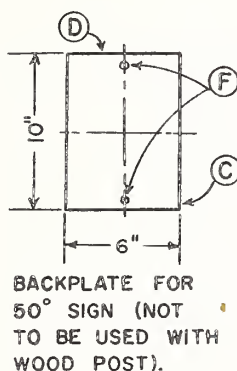
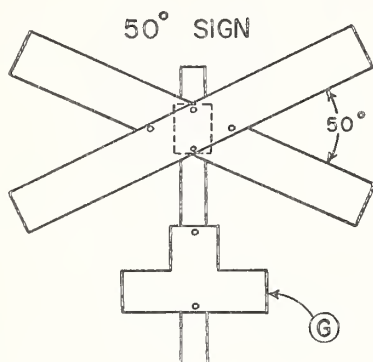
1. Mounting systems shown are typical. Other systems may be approved by the engineer.
2. All steel hardware shall be galvanized.

State Highway Commission
Helena, Montana

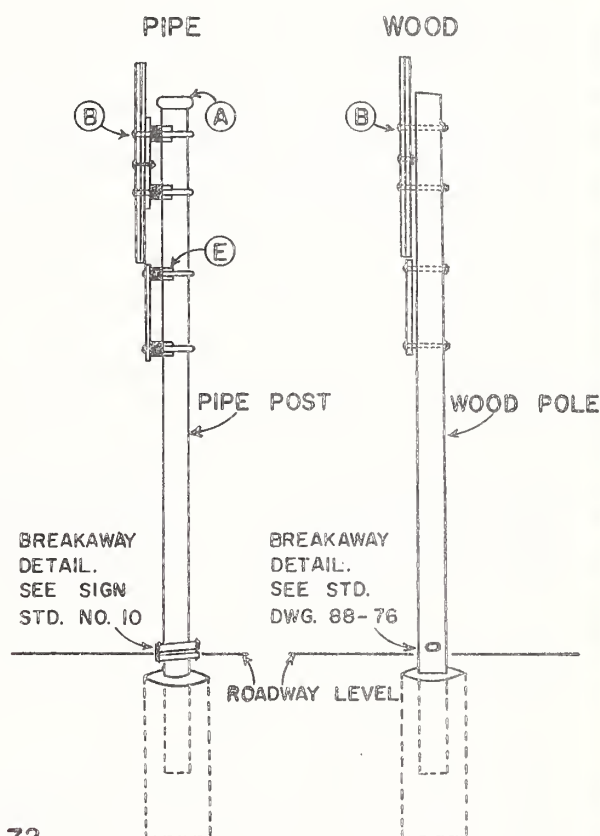
RAILROAD CROSSING SIGNS

Approved
Leur M. Culbert
State Highway Engineer

W10-2



SEE STD. DWG. NO. 88-72



REFERENCE NOTES

THE RAILROAD CROSSING SIGN AND THE ADVANCE WARNING SIGN ARE SHOWN IN THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES FOR STREETS AND HIGHWAYS.

- Ⓐ A SUITABLE WATER-TITE CAP SHALL BE PLACED ON ALL PIPE POSTS.
- Ⓑ BOLTS 5/8" 11NC-2-SQ. HD. HEX. NUT. LENGTH AS REQUIRED. USE ALUMINUM BOLTS, NUTS AND WASHERS WITH ALUMINUM SECTION.
- Ⓒ BACK PLATE: USE WITH ALUMINUM SECTION ONLY.
- Ⓓ BACK PLATE SHALL BE 0.125 MINIMUM THICKNESS, 6061-T6 ALUMINUM ALLOY.
- Ⓔ CLAMPS: ASSOCIATION OF AMERICAN RAILROADS, SIGNAL SECTION DRAWING NO. 1547-C OR EQUAL.
- Ⓕ 11/16" HOLES LOCATED AS REQUIRED TO FIT ALUMINUM SECTION USED.
- Ⓖ MULTIPLE TRACK SIGN SHALL BE FABRICATED FROM 18 GAGE FLAT STEEL OR 0.080 INCH MINIMUM THICKNESS 6061-T6 ALUMINUM ALLOY SHEET.

RAILROAD CROSSING SIGN SHALL BE FABRICATED FROM 0.125 ALUM. OR 16 GA. STEEL PLATE HAVING AN APPROVED SYNTHETIC OR VITREOUS ENAMEL FINISH, OR AN EXTRUDED ALUMINUM ALLOY SECTION HAVING A MINIMUM SECTION MODULUS OF 0.074 NORMAL TO THE FACE OF THE SIGN. 6061-T6 ALLOY SHALL BE USED.

POST SHALL BE WROUGHT IRON, STEEL, OR TREATED TIMBER POLE. IF BLACK IRON PIPE IS USED, PIPE, CLAMPS, AND CAPS SHALL BE PAINTED ONE SHOP COAT RED LEAD, ONE FIRST FIELD COAT RED LEAD, AND ONE FINAL COAT OF ALUMINUM. FOR POST SPECIFICATIONS, SEE PLANS "LOCATION AND ERECTION SPECIFICATION" SHEET.

ALUMINUM SIGNS, IF USED, SHALL BE DEGREASED AND ETCHED TO PROVIDE PROPER ADHESION FOR REFLECTIVE SHEETING WITHOUT FURTHER TREATMENT.

CROSSBUCKS AND MULTIPLE TRACK SIGN SHALL BE WHITE REFLECTORIZED BACKGROUND WITH BLACK LETTERS AND NUMERALS.

SIGN SHALL BE LOCATED 10 FT. CLEAR FROM EDGE OF SHOULDER OR 2 FT. FROM FACE OF CURB OR GUARDRAIL.

SIGN, INDICATING NUMBER OF TRACKS, SHALL BE USED WHERE THERE ARE TWO OR MORE TRACKS. THE NUMBER DISPLAYED ON THE SIGN SHALL BE THE TOTAL NUMBER CROSSED, INCLUDING SIDINGS. THE DISTANCE THAT SHALL BE ASSUMED TO SEPARATE TRACKS BEFORE AN ADDITIONAL CROSSING SIGN IS CONSIDERED, IS 100 FT., UNLESS LOCAL CONDITIONS REQUIRE OTHERWISE.

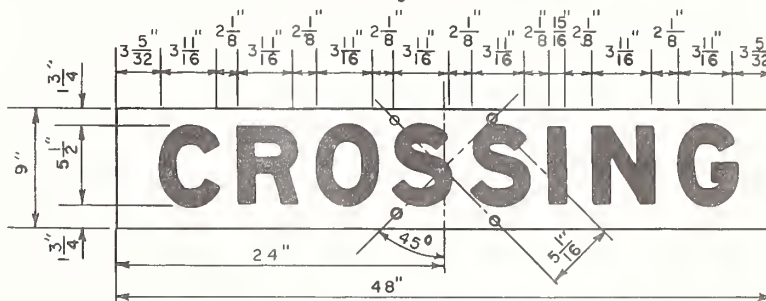
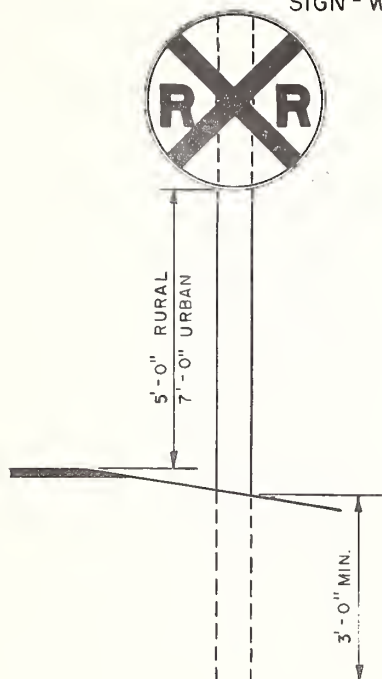
State Highway Commission
Helena, Montana

RAILROAD CROSSING SIGNS

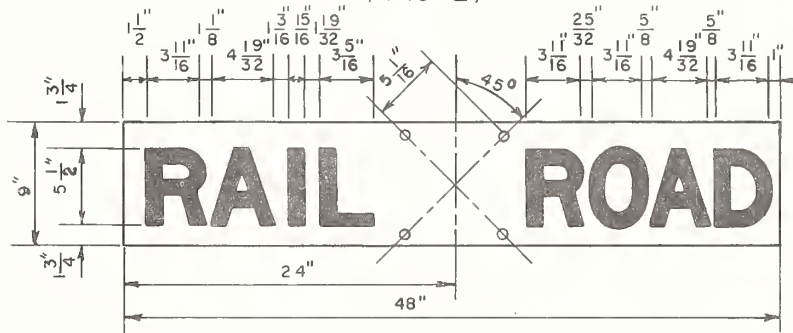
Approved
James M. Patton
State Highway Engineer

ADVANCE WARNING
SIGN - W10-1

See Std. Dwg. No. 88-71



(W10-2)

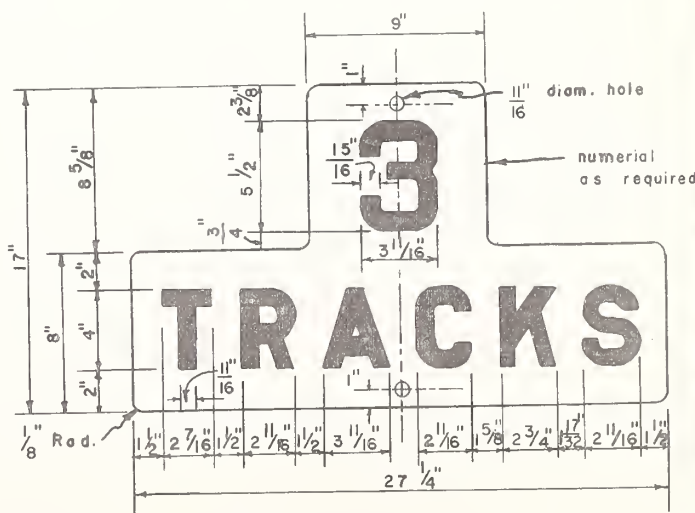
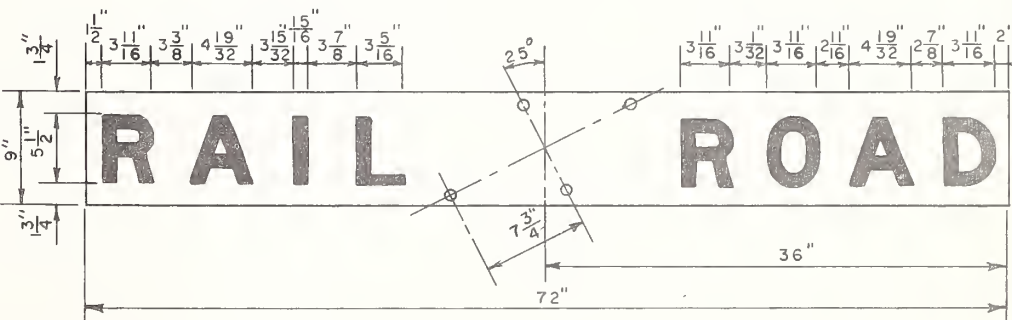
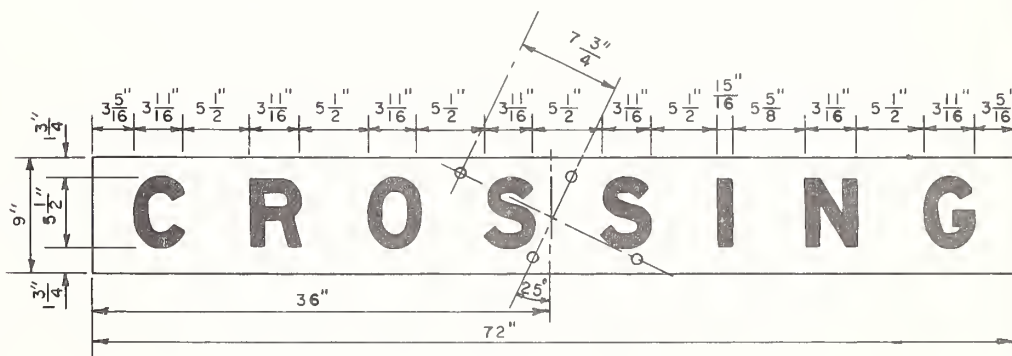


The Advance Warning Signs shall be the standard W10-1 36" diameter sign shown in the Manual on Uniform Traffic Control Devices for Streets and Highways. It shall have black legend on a reflectorized yellow background. The sign shall be constructed of 6061-T6 aluminum sheet, 0.100 inch minimum thickness. Fabrication shall conform with the Standard Specifications.

The W10-1 sign shall be erected with a 10 ft horizontal clearance from the edge of the shoulder or face of the curb. The mounting height to the bottom of the sign shall be 5 ft. in rural areas and 7 ft. in urban areas.

In rural areas a treated timber pole or post (break-away design) shall be used. See Std. Dwg. 88-76. In urban areas a 2 1/2" diameter pipe post using the breakaway device as shown on sign standard No. 10.

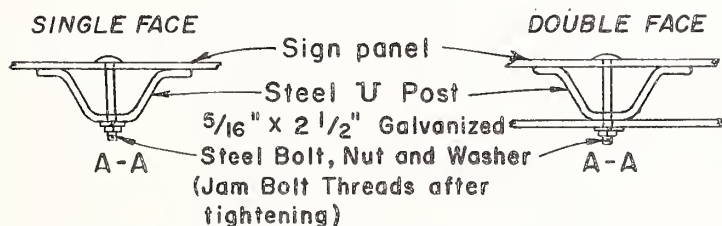
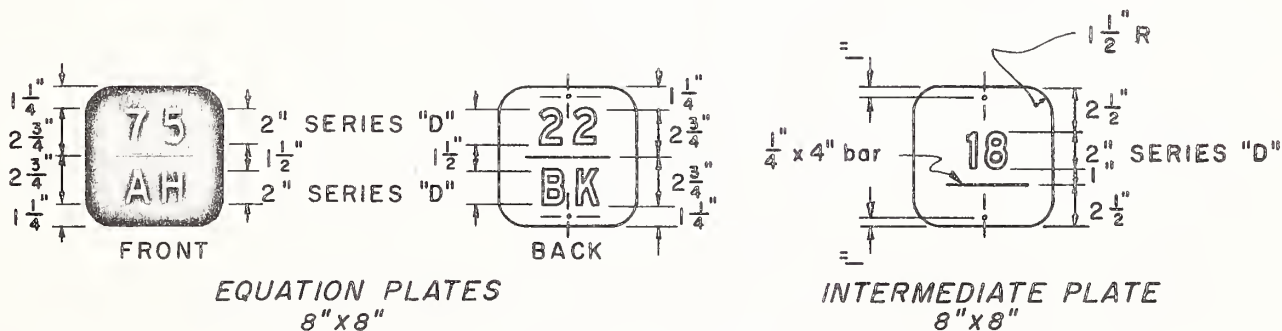
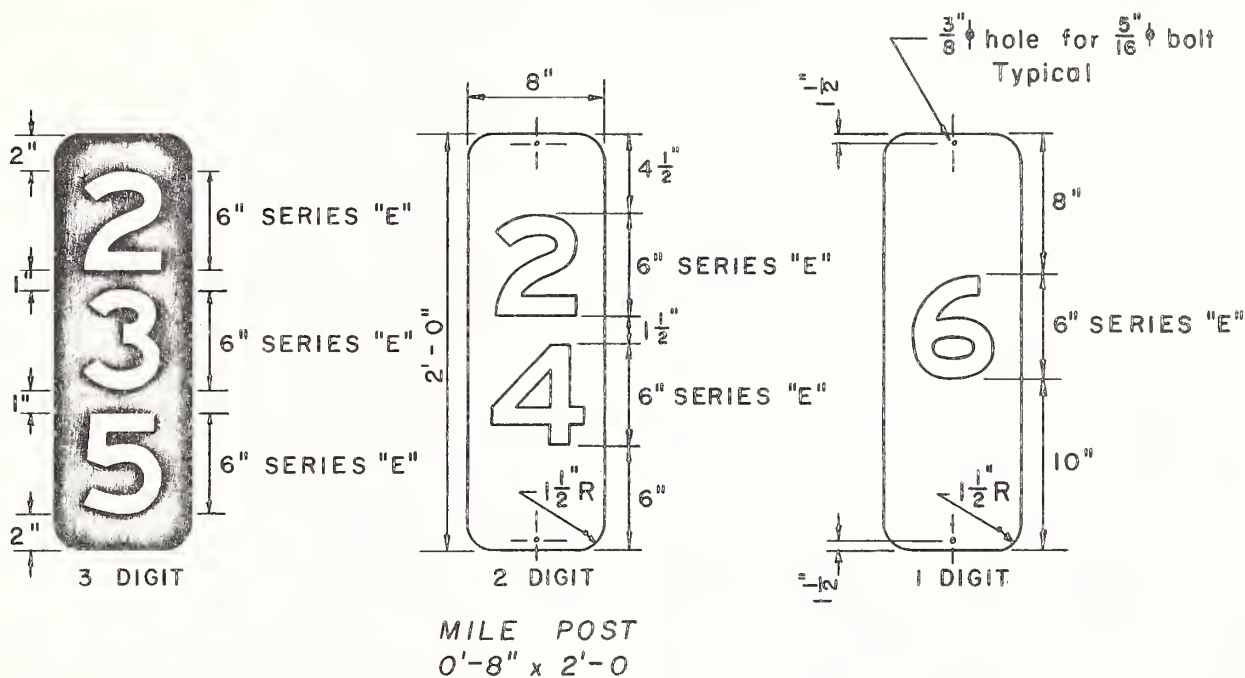
Bolts shall be 5/16" aluminum, galvanized steel or cadmium plated steel, lengths as required.



State Highway Commission
Helena, Montana

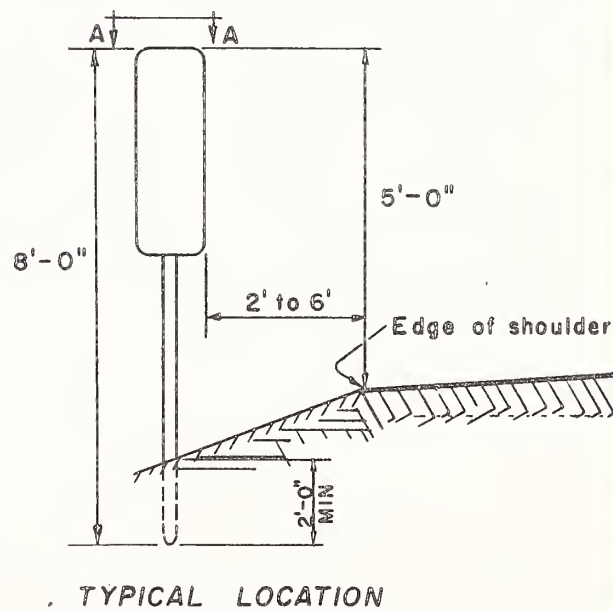
INTERSTATE & PRIMARY MILEPOSTS

Approved

James J. Phillips 11-5-68
State Highway Engineer

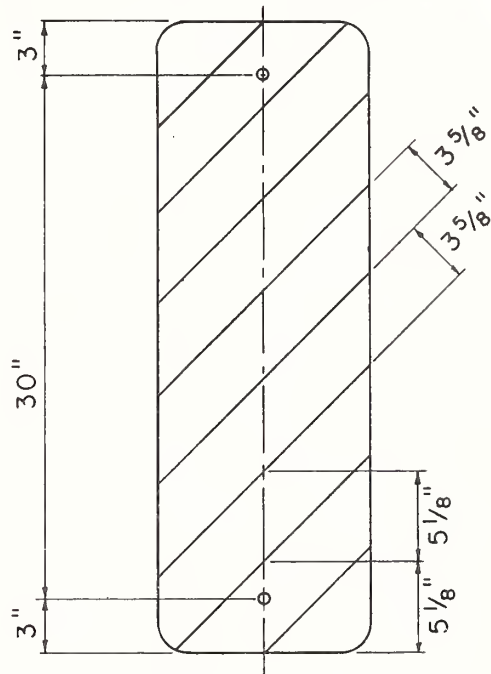
NOTES:

1. Mile post shall be in general alignment with the delineators and/or signs.
2. When an equation is posted a supplementary plate will be placed below the standard mile post giving the decimal of a mile to the nearest hundredth.
3. When an intermediate point is posted a supplementary plate will be placed below the standard mile post giving the decimal of a mile at that point to the nearest hundredth.
4. Mile posts and supplemental plates will have white reflectorized letters (non-removable copy) on a green reflectorized background.
5. Bolts shall be galvanized or cadmium plated steel or aluminum. Posts shall be 2 lb. per foot steel U posts with 36, 3/8" holes on 1" centers starting 1" below the top and shall be galvanized.





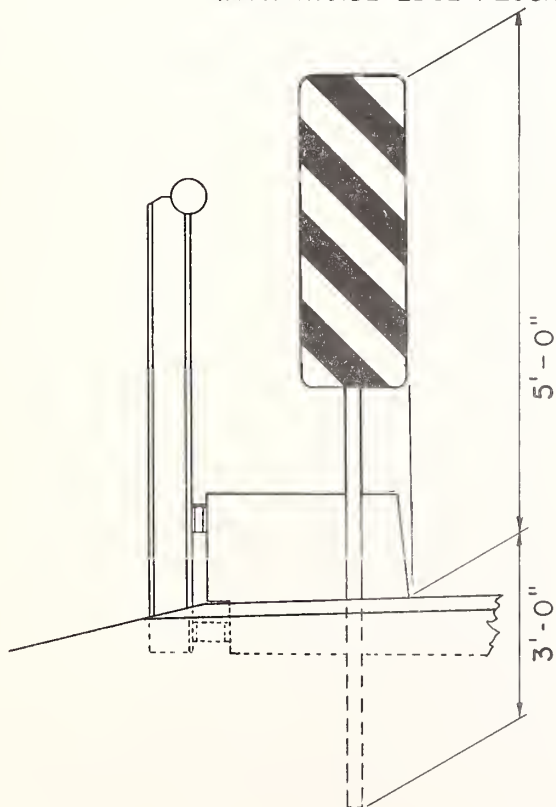
12" X 36"



NOTE:

STRIPES SHALL BE BLACK AND REFLECTORIZED WHITE.

PANELS SHALL BE MOUNTED ON GALVANIZED STEEL U POSTS 2 LBS./FT.
WITH INSIDE EDGE FLUSH WITH FACE OF CURB.



* For Erection Details see
Std. Drawing 88-57

A Suitable water-tight cap to be
placed on all pipe posts.

2" OR 2 1/2" PIPE POST MAY BE GALVANIZED

Face of curb

Class "DD" concrete or
equal. See Std. Spec.

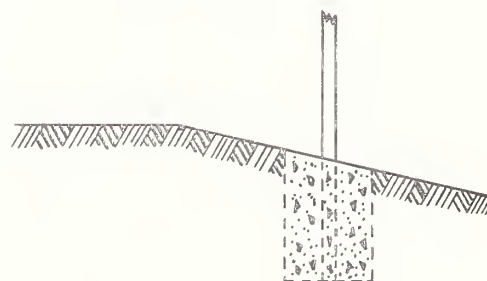
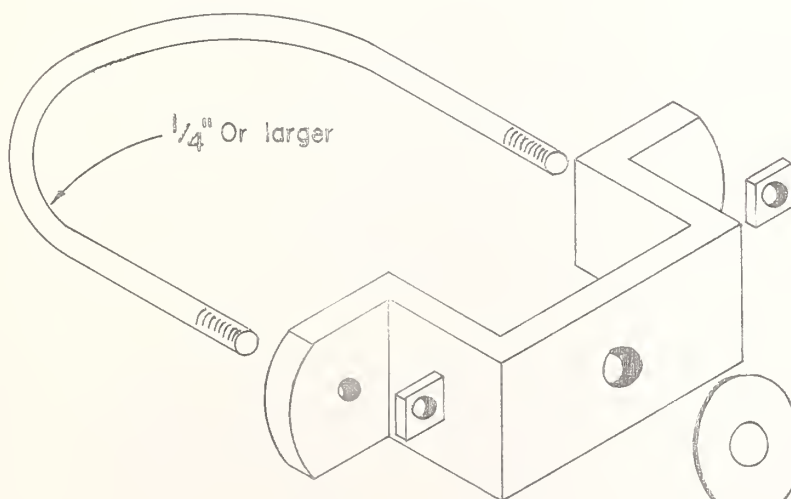
3'-0"

1'-0"

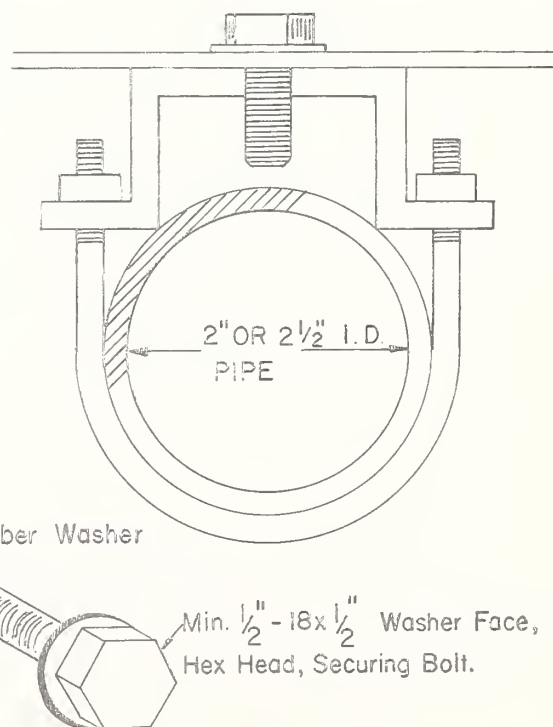
CURB MOUNTING

NOTE: For back to back sign installation, two
"U" brackets will be required using two-
2 1/2" x 1/4" carriage bolts in place of "U" bolt.

All hardware shall be cadmium plated or
galvanized.



SLOPE MOUNTING



TYPICAL "U" BRACKET FOR 2" OR 2 1/2" PIPE POST

STANDARD BREAK AWAY DETAIL

SINGLE OR MULTIPLE ROUND TIMBER POLES

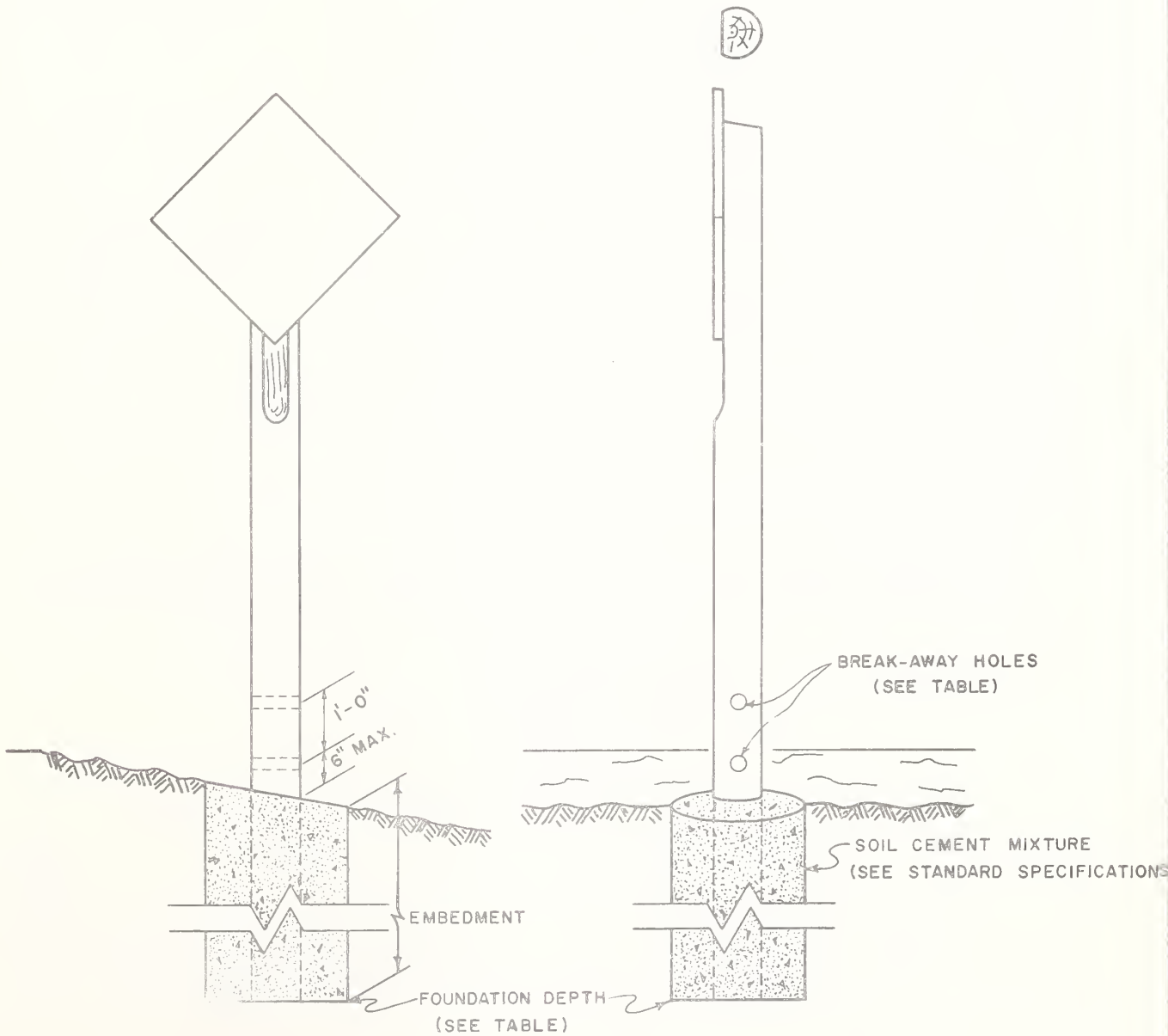


TABLE OF DIAMETERS & FOUNDATIONS		
POLE SIZE	HOLE DIA.	EMBEDMENT
3" TOP Ø	—	3' - 0"
4" TOP Ø	1 1/2"	3' - 0"
5" TOP Ø	1 7/8"	3' - 6"
6" TOP Ø	2 1/8"	3' - 6"
CLASS 4	2 1/2"	4' - 0"
CLASS 3	2 5/8"	4' - 0"

NOTES:
 ALL CUTTING, TRIMMING AND BORING
 OF TREATED TIMBER POLES SHALL BE
 IN ACCORDANCE WITH STANDARD SPECIFICATIONS.

 TREATED TIMBER POSTS, 4"X 4" OR 4"X 6"
 WILL NOT REQUIRE HOLES FOR BREAKAWAY DESIGN.

Drawn 3-1-66

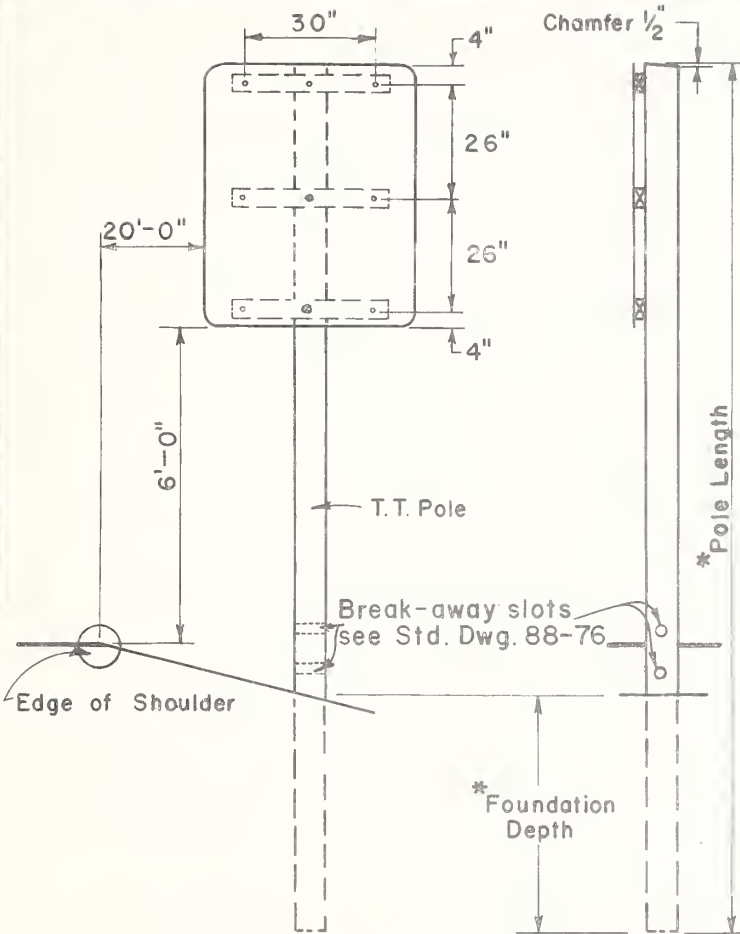
Revised 11-1-68 9-1-70
Effective 1-1-69 1-1-71

STANDARD DRAWING NO. 88-77

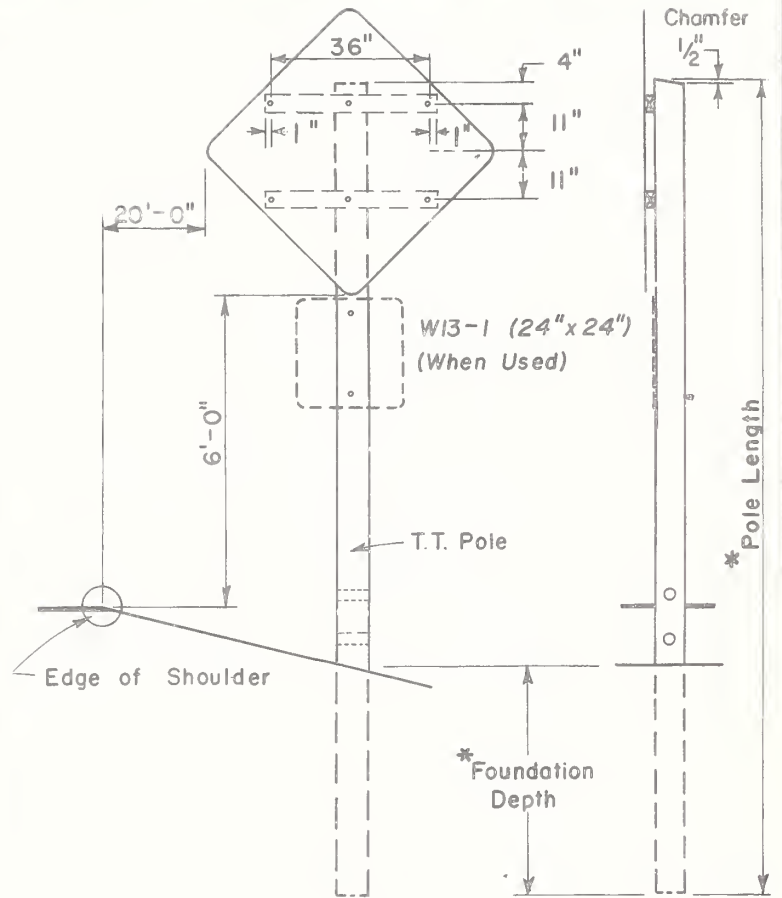
State Highway Commission
Helena, Montana

TYPICAL SIGN ERECTION

Approved
James J. Patton
State Highway Engineer

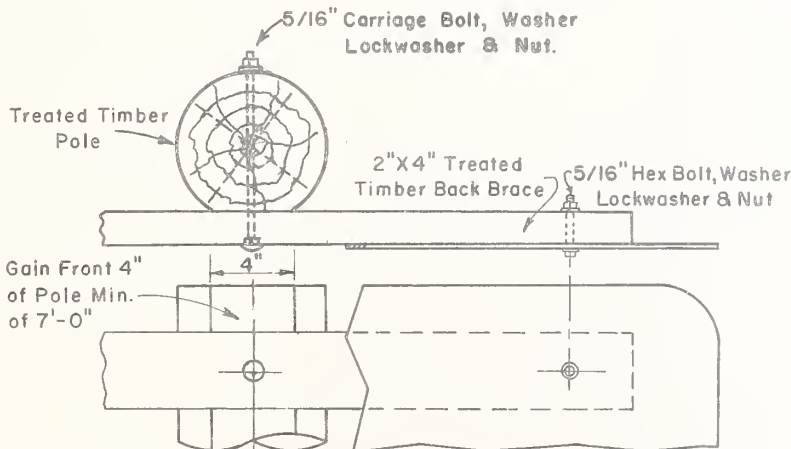


TYPICAL ERECTION
48" x 60" REGULATORY SIGN



TYPICAL ERECTION
48" x 48" WARNING SIGN

* For Pole Lengths and Foundation Depth-See Sign Plans "Sign Location and Erection" Sheet. For details see Std. Dwg. 88-76



NOTE:

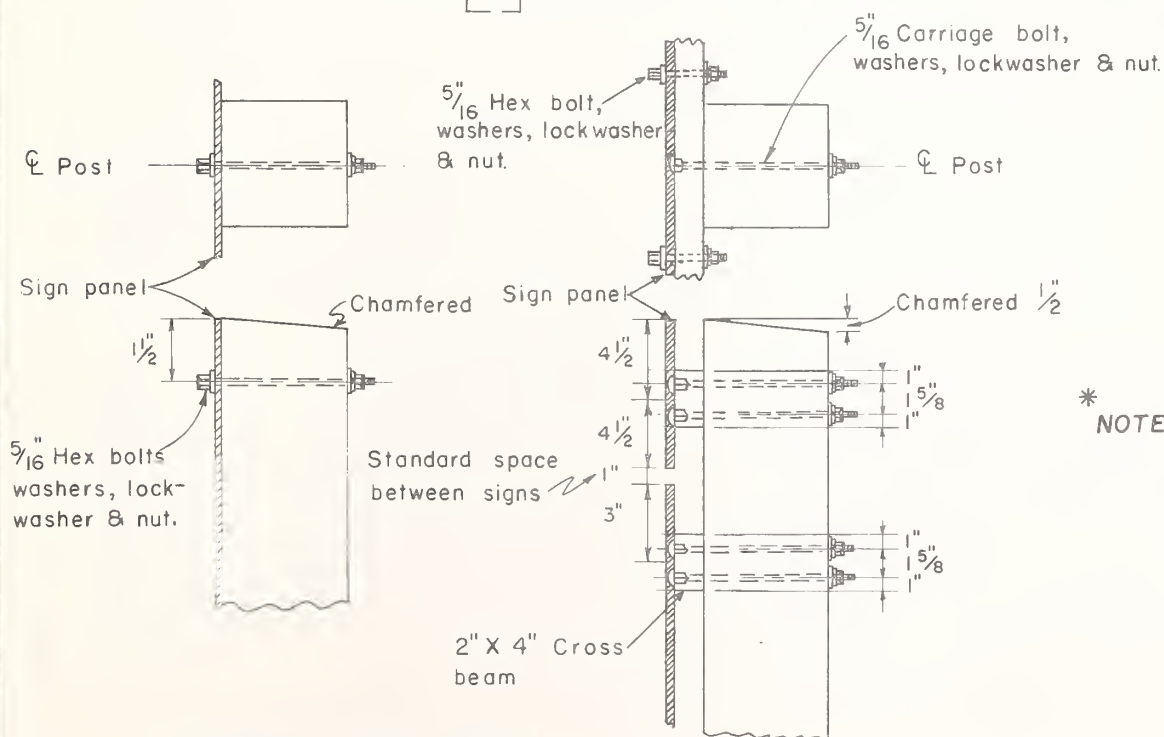
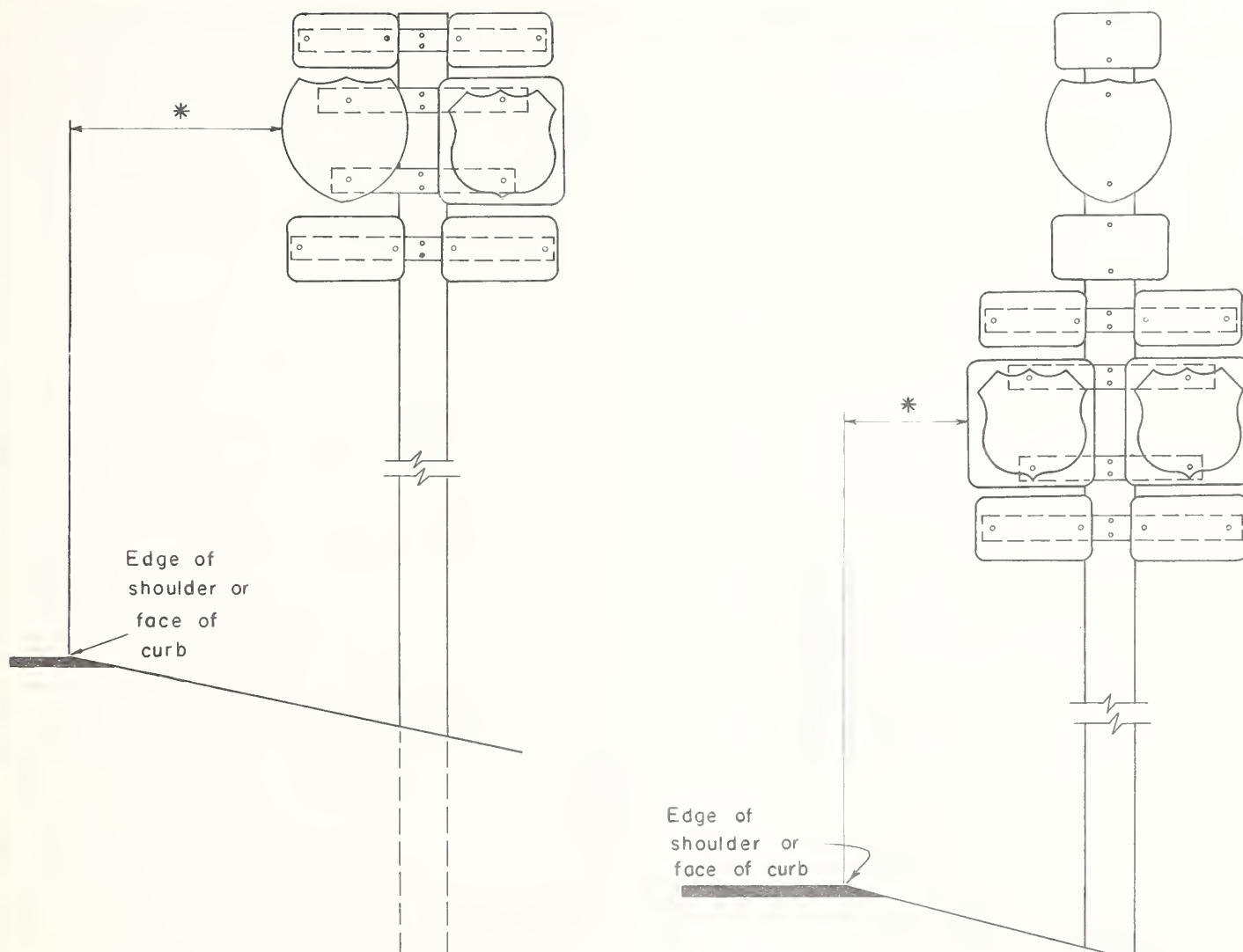
Signs greater than 10 sq. ft. shall be mounted 20' from shoulder edge. Caution should be taken to avoid placing signs in a position where it is not easily visible to the motorist.

SIGN FASTENING AND BACK BRACE DETAILS

State Highway Commission
Helena, Montana

TYPICAL ROUTE MARKER ASSEMBLY WITH TREATED TIMBER POST

Approved
[Signature] 12-15-67
 State Highway Engineer



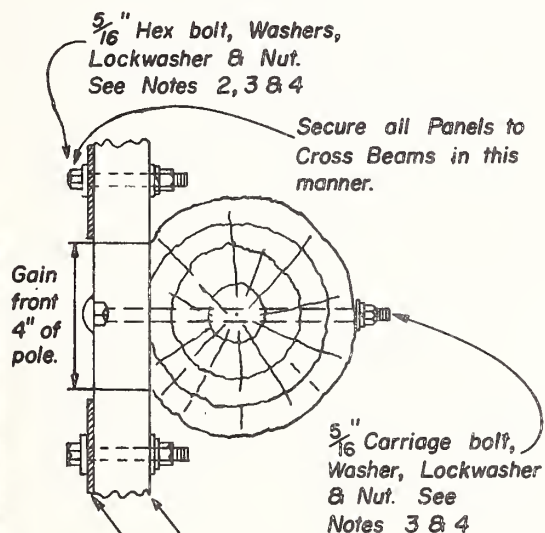
* NOTE: See Std. Dwg. No. 88-79
For Notes.

TREATED TIMBER POST
W/ out CROSSBEAMS

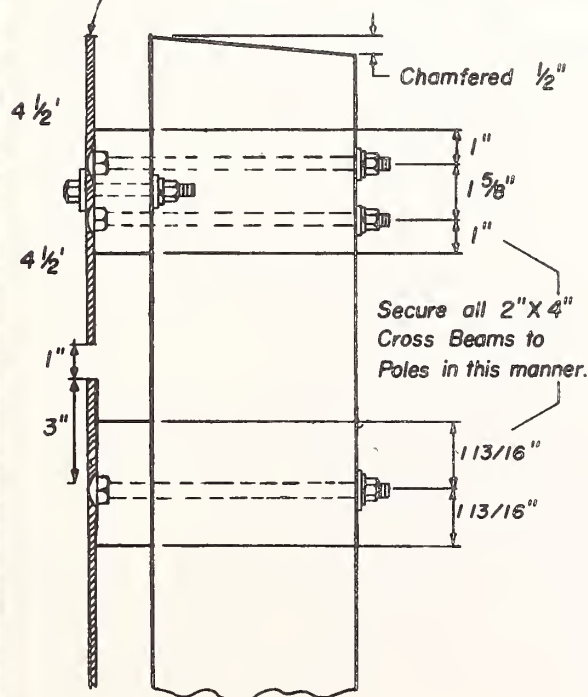
TREATED TIMBER POST
W/ CROSSBEAMS

State Highway Commission
Helena, MontanaTYPICAL ROUTE MARKER ASSEMBLY
WITH TREATED TIMBER POLEApproved
Paul A. Phillips
State Highway Engineer

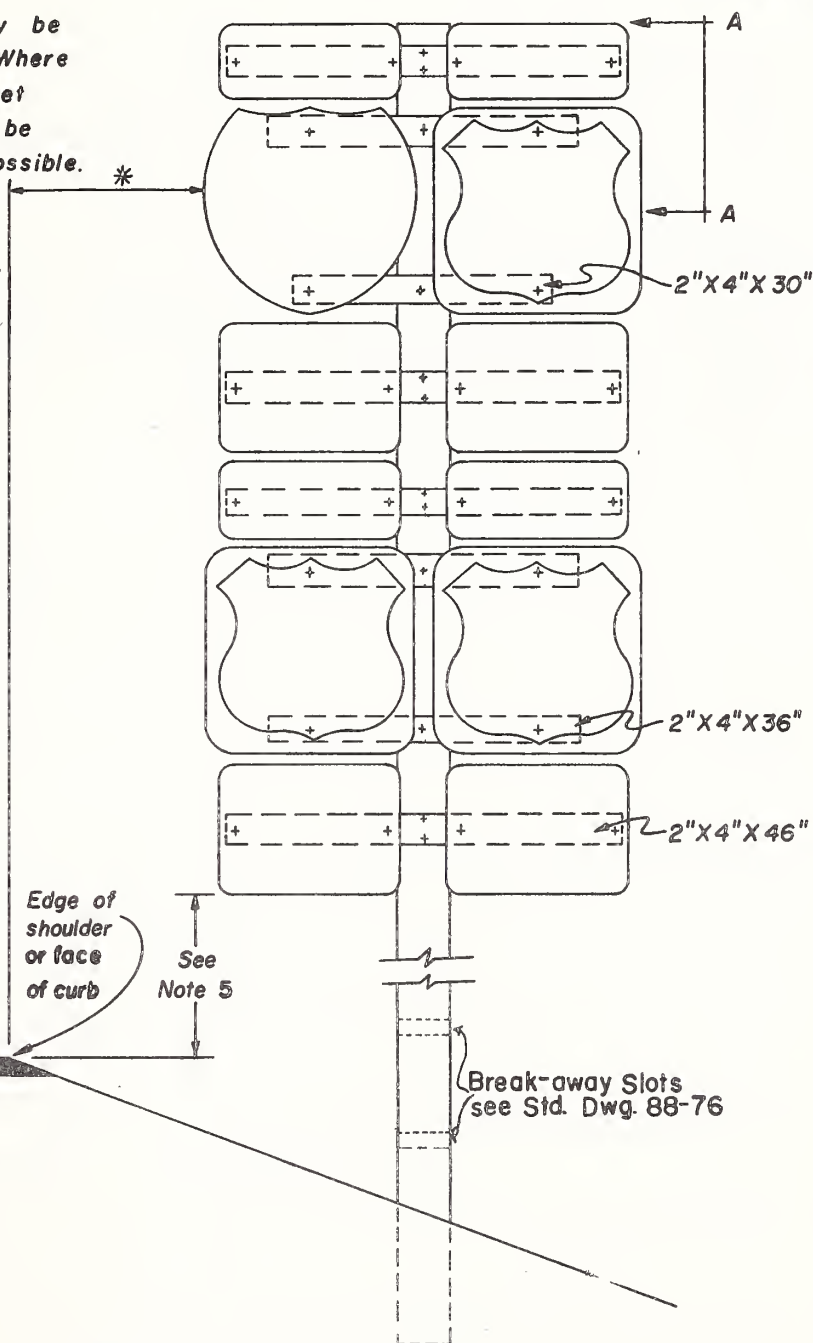
* Route Marker assemblies should normally be mounted 10 ft. from edge of shoulder. Where an assembly is used that is 10' square feet or over — the assembly should be mounted 20 ft. from shoulder edge if possible. Caution should be taken to avoid placing route marker in a position where it is not easily visible to the motorist.



Sign Panel 2"X 4" Cross Beam



ELEVATION A-A



NOTES

1. Vertical spacing between panels shall be 1".
2. All bolts, nuts & washers shall be aluminum, stainless steel or cadmium plated steel.
3. All bolt holes drilled in wood shall be $\frac{5}{16}$ " in diameter. All bolt holes drilled in metal shall be $\frac{3}{8}$ " in diameter.
4. A typical route marker group is shown. Other groups are mounted similarly.
5. Mounting height is 5'-0" in rural areas, 6'-0" on interstate, interchange ramps and crossroads, and 7'-0" in urban areas.
6. The widest route markers in an assembly shall be separated by 2" horizontally, with other panels centered above or below accordingly.

Drawn 3-1-66

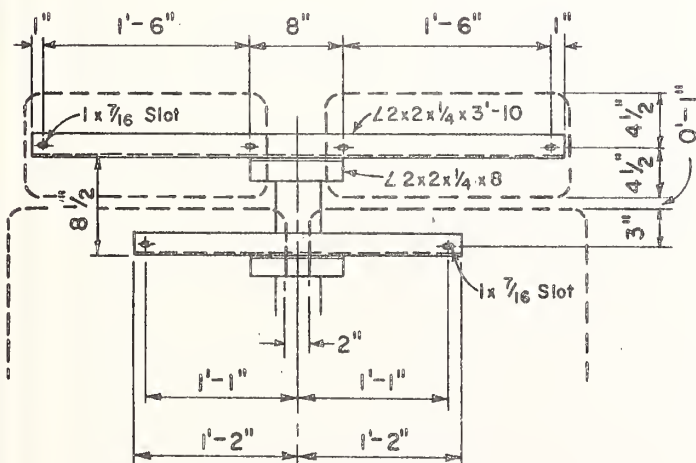
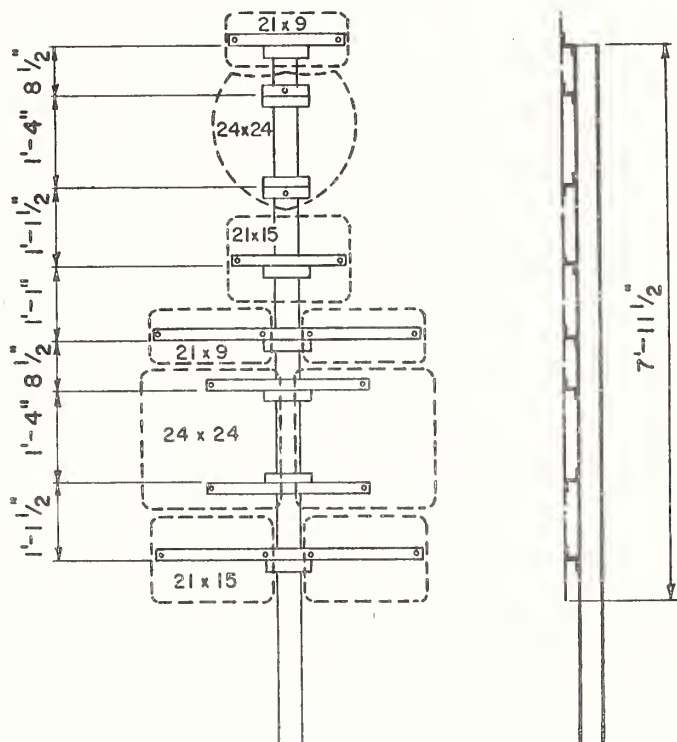
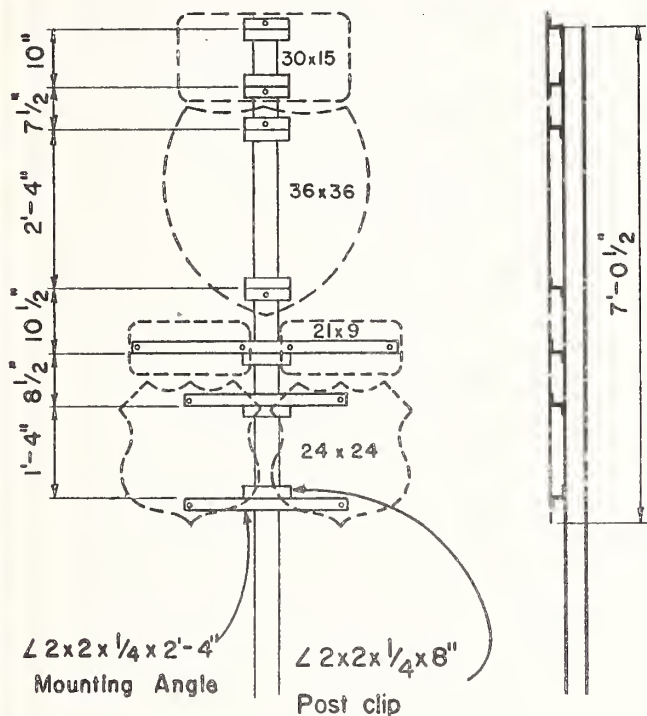
Revised 11-1-68
Effective 1-1-69

STANDARD DRAWING NO. 88-80

State Highway Commission
Helena, Montana

TYPICAL ROUTE MARKER ASSEMBLIES WITH STEEL POSTS

Approved
James M. Chubb
State Highway Engineer



TYPICAL MOUNTING DETAIL
STRUCTURAL STEEL POSTS

NOTES:

1. For mounting of sign panels, post clips and mounting angles for pipe posts, see Sign Standard No. 9.
2. Bolt holes for mounting sign panels shall be drilled or punched according to Standard Drawing No. 88-04
3. Assemblies shown are typical installations. Similar assemblies shall be erected in a like manner.
4. Break-away post and foundation details are shown on Sign Standard No. 9.
5. Type and length of post, mounting height, & foundation depth are shown on the Sign Location and Erection Spec. Sheet
6. The widest Route Markers in an assembly shall be separated by 2" horizontally with other panels centered above or below accordingly. Vertical spacing between all panels shall be 1".

Drawn 3-1-66

Revised 11-1-68

Effective 1-1-69

STANDARD DRAWING NO.

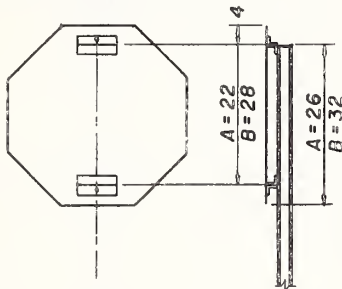
88 - 81

State Highway Commission
Helena, MontanaTYPICAL SIGN ERECTION
STEEL POSTS

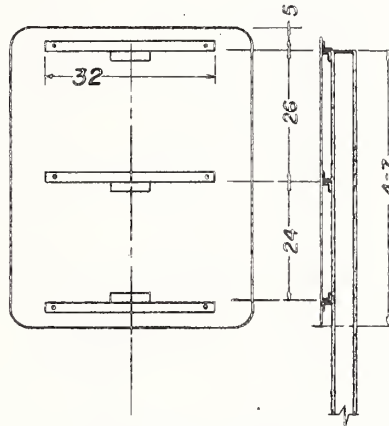
Approved

Lewis M. Chaffin
State Highway Engineer

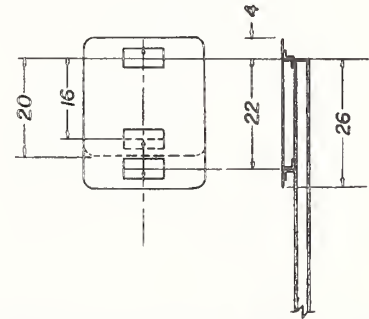
* SIGNS OF APPROXIMATE 5 SQ. FT. OR LESS
MAY BE MOUNTED ON 2" PIPE POST
USING CLAMPS SHOWN ON STANDARD
DRAWING 88-75 FOR LARGER POSTS.
SEE SIGN STANDARD NO. 10.



* A = 30 x 30 STOP SIGN
B = 36 x 36 STOP SIGN

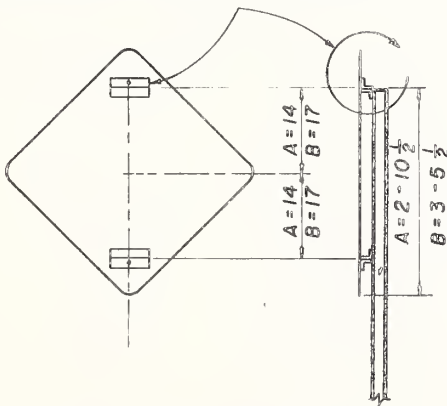


48 x 60 REGULATORY SIGN

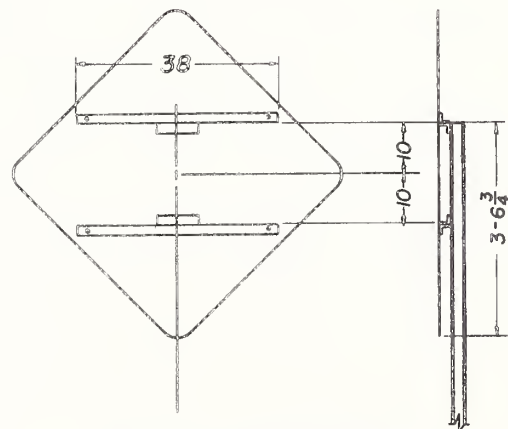


* 24 x 24 REGULATORY SIGN
* 24 x 30 REGULATORY SIGN

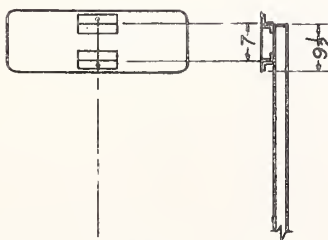
THIS TYPICAL 8" MOUNTING ASSEMBLY
SHALL BE USED ON ALL SIGNS WHERE
THERE IS NO HORIZONTAL HOLE SPACING



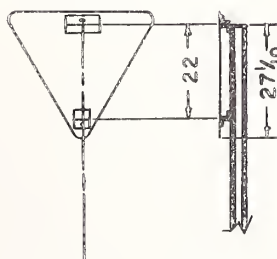
A = 30 x 30 WARNING SIGN
B = 36 x 36 WARNING SIGN



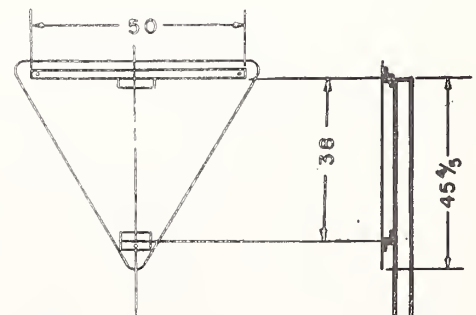
48 x 48 WARNING SIGN



* 36 x 12 ONE WAY SIGN



36 x 36 x 36 YIELD SIGN



60 x 60 x 60 YIELD SIGN

① Location Of Signs By Station, Panel Material, Post Type & Length, Mounting Height, And Depth Of Foundation Are Found On The SIGN LOCATION & ERECTION SPECIFICATIONS.

② Elevations Shown Are Typical Installations. For Similar Installations Not Shown, The Length Of The Mounting Angles Shall Be The Horizontal Hole Centers Plus Two

Inches. The Vertical Spacing Is Determined By The The Vertical Hole Centers.

③ The Hole Centers For Each Sign Are Found On STANDARD DRAWING NO. 88-02 & 88-03

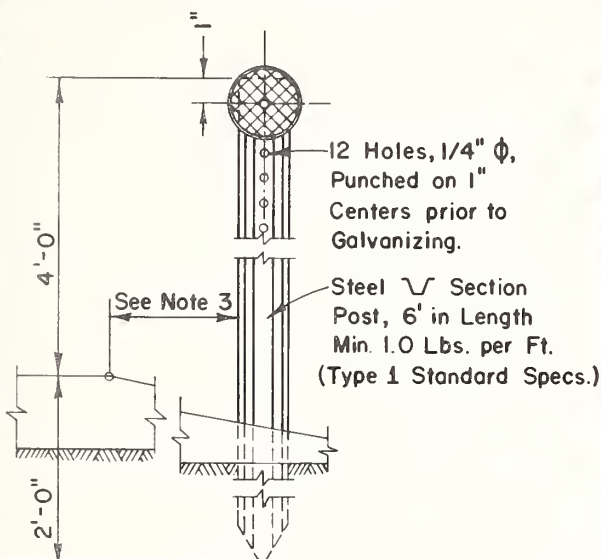
④ When Using Pipe Posts, A Suitable Watertite Cap Shall Be Placed On All Posts.

State Highway Commission
Helena, Montana

DELINEATORS TYPE I

Approved

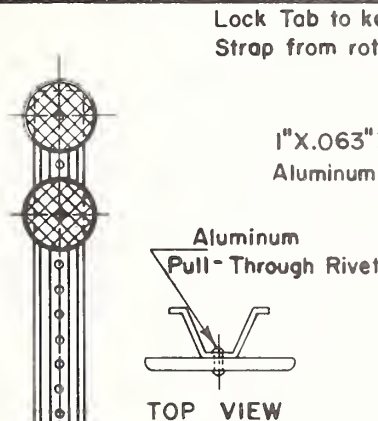
State Highway Engineer



DESIGN "A"
(CRYSTAL)

Typical Use:

Interstate - Continuous along roadway.
Primary & Secondary - Where warranted.



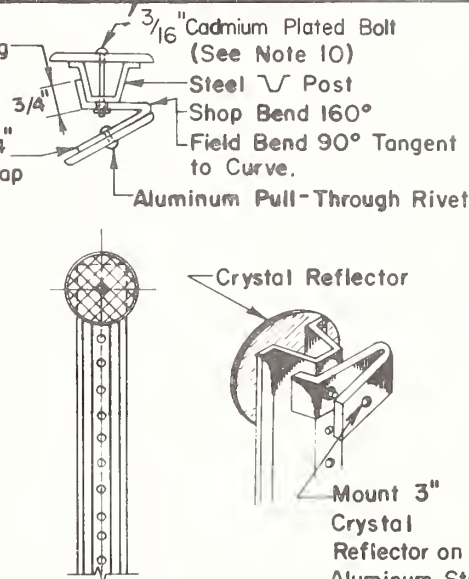
DESIGN "B"
(AMBER)

Typical Use:

All ramps and speed change lanes.

Special Use:

Construction zones or temporary connections, only as warranted by an engineering study.

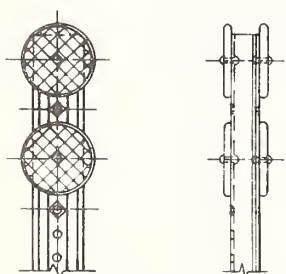


DESIGN "C"

(CRYSTAL, BI-DIRECTIONAL)
(ADJUSTABLE)

Typical Use:

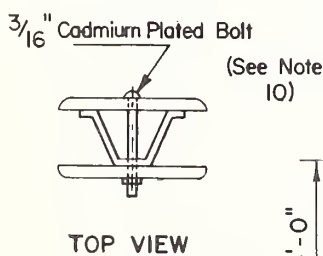
Unusual situations as specified.



DESIGN "D"
(AMBER, BI-DIRECTIONAL)

Typical Use:

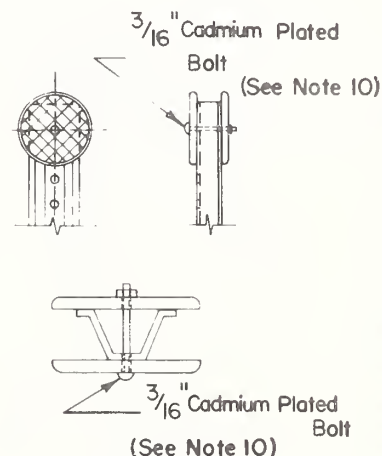
Ramp terminus with crossroad.
Road approaches to major highway.



DESIGN "E"
(AMBER)

Typical Use:

Mounted in gore at exit ramps. At curbed nose of median or other channelization.



DESIGN "F"

(CRYSTAL, BI-DIRECTIONAL)

Typical Use:

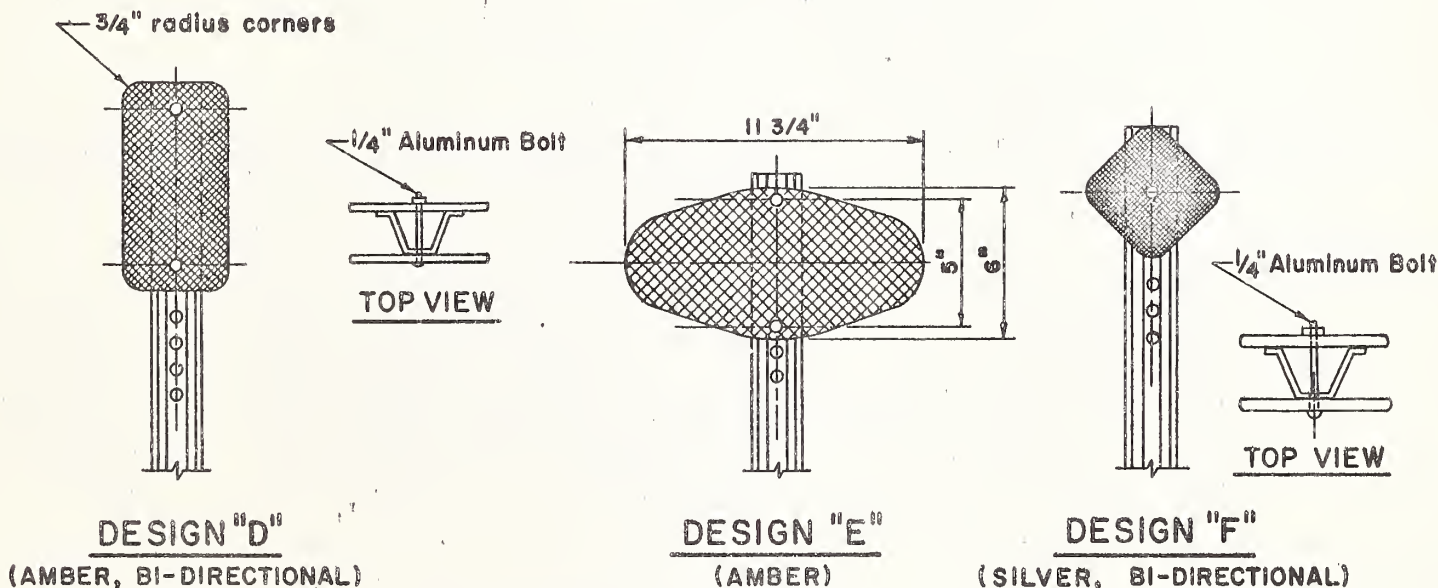
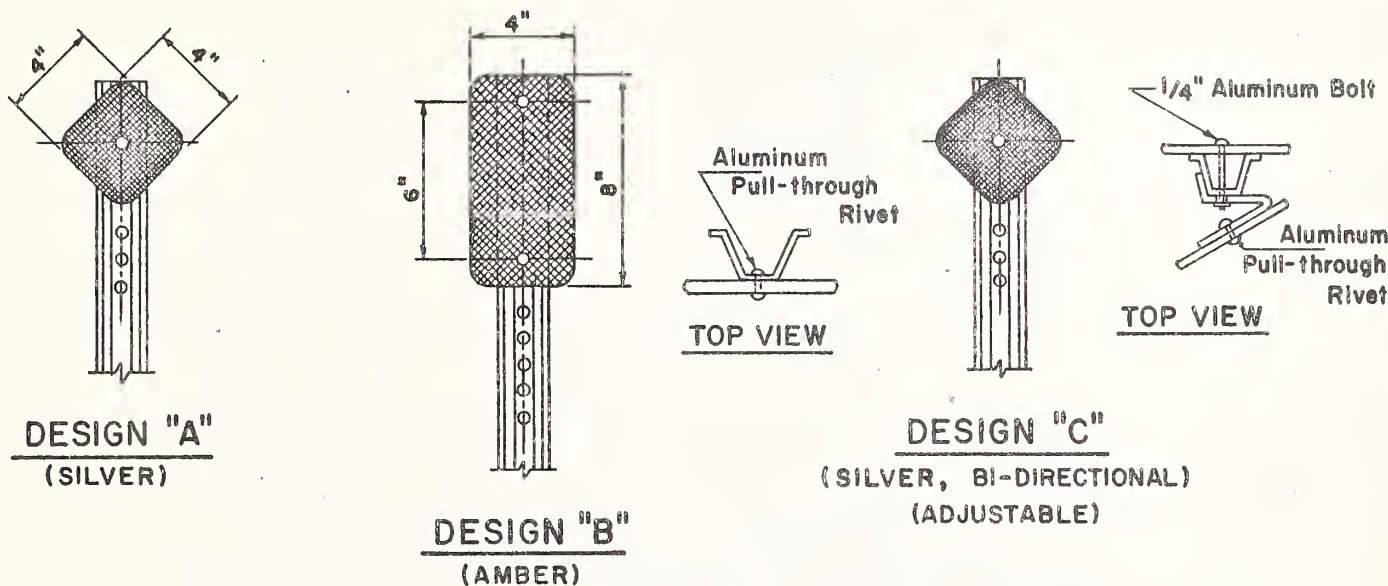
Tangent run-off in conjunction with Design "C".

NOTES:

1. Post type shall be as shown in DESIGN "A" for all designs.
2. Reflectors shall be center mount.
3. Post with delineators shall be placed facing oncoming traffic, 2' to 4' clear from edge of shoulder or the face of curb, or as shown on plans.
4. Posts shall be driven, using an approved metal driving cap, prior to installation of the delineators.
5. All sheet aluminum shall conform to Standard Specifications.
6. For spacing of delineators, see Horizontal Spacing Chart, Standard Drawing No. 88-92
7. On tangents, unless otherwise specified in the plans, the nominal spacing of delineators shall be 300'.

8. Posts shall be installed behind guard rail posts where there is guard rail installed along the highway.
9. Where, under normal spacing, a delineator post falls within a crossroad, that post may be moved in either direction a distance not to exceed one quarter of the normal spacing.
10. 3/16" Cadmium Plated Bolt of suitable length. Jam threads after turning nut tight to prevent removal. Rivet delineators to plate prior to mounting.

DELINEATOR LEGEND			
—	DESIGN A	—	DESIGN D
—	DESIGN B	—	DESIGN E
—	DESIGN C	—	DESIGN F



**SPECIFICATION FOR ENCAPSULATED LENS
WIDE ANGLE REFLECTIVE SHEETING DELINEATORS**

PHOTOMETRIC

Material for reflective delineators shall have the following minimum brightness values at .2° and .5° divergence expressed as average candlepower per foot-candle per square foot of material. Measurements shall be conducted in accordance with standard photometric testing procedures for reflectors of Federal Specification L-S-300 "Sheeting and Tape, Reflective; Nonexposed Lens Adhesive Backing".

The brightness of the reflective sheeting, totally wet by rain, shall not be less than 90% of the above values. Wet performance measurements shall be conducted in conformance with standard rainfall test specified in Federal Specification L-S-300 or as amended.

Divergence Angle: Incidence Angle	Silver		Yellow Amber	
	.2	.5	.2	.5
-4°	155	65	60	20
15°	100	50	42	17
30°	50	25	17	10
45°	10	5	6	2.5

NOTES:

- The aluminum shall be .063" thick.
- Delineators shall have square mounting holes for 1/4" diameter carriage bolts.
- For other details and notes, see Std. Dwg. No. 88-91.

Drawn 5-1-65

REVISED	11-1-68	11-1-69	9-1-70	7-9-71
EFFECTIVE	1-1-69	1-1-70	1-1-71	8-1-71

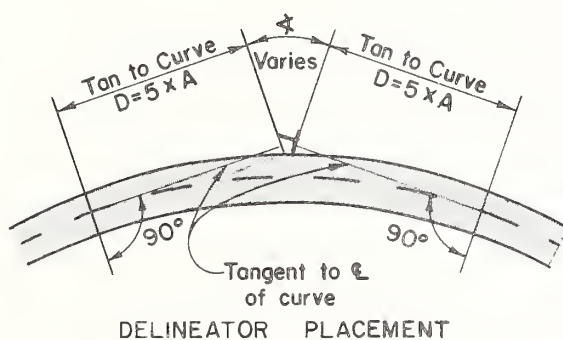
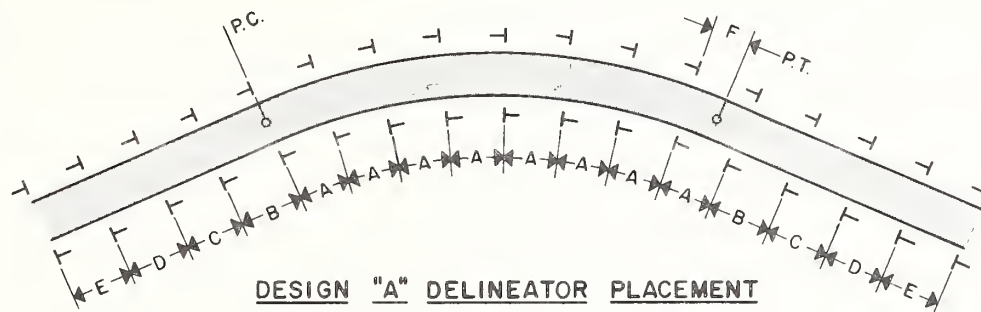
STANDARD DRAWING NO. 88-92

State Highway Commission
Helena, Montana

DELINEATOR SPACING FOR HORIZONTAL HIGHWAY CURVES

Approved

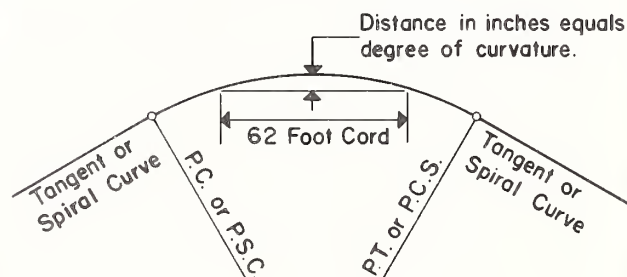
James M. Chittling 12-15-67
State Highway Engineer



Position delineator faces perpendicular to tangent to center line of curve as shown. Spacing shall be as called for in Table below.

HORIZONTAL CURVE SPACING TABLE					
DEGREE OF CURVE	SPACING "A" ON CURVE	SPACING ON BOTH APPROACHES			
		B	C	D	E
0° TO 30'	300'	300'	300'	300'	300'
30' TO 1°	300'	300'	300'	300'	300'
1° TO 2°	250'	300'	300'	300'	300'
2° TO 3°	175'	300'	300'	300'	300'
3° TO 4°	120'	240'	300'	300'	300'
4° TO 6°	90'	180'	270'	300'	300'
6° TO 8°	85'	170'	255'	300'	300'
8° TO 12°	75'	150'	225'	300'	300'
12° TO 20°	60'	120'	180'	300'	300'
20° PLUS	40'	80'	120'	240'	300'

FIELD METHOD FOR DETERMINING DEGREE OF HORIZONTAL CURVES



NOTES:

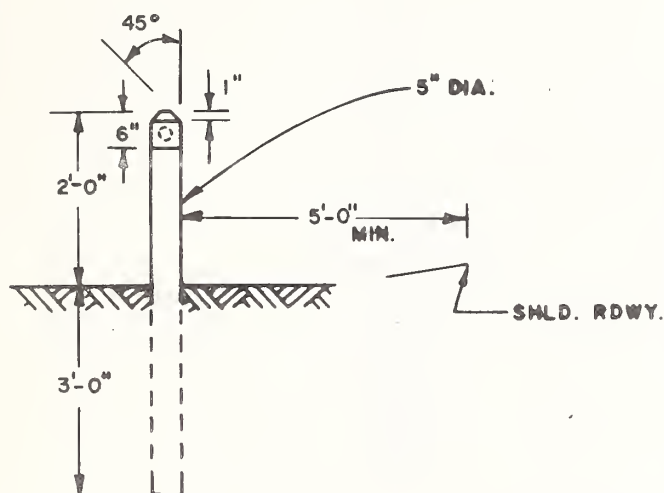
1. If distance F is 20 feet or more, add one regular "A" space as called for in the above table.
2. See Standard Drawing No. 88-91A for Delineator Design Details.
3. Post with delineators shall be placed on the right hand side facing oncoming traffic, 2' to 4' clear from edge of shoulder or the face of curb, or as shown on the plans.
4. Type I Delineator button shall be a nominal 3" diameter reflector as specified by Standard Specifications.
5. Delineator spacing on Tangent, shall be 300', unless otherwise noted on project plans.
6. Federal Aid highways shall be continuously delineated.
7. Interstate highways with split alignments shall be delineated on the inside shoulder at double the normal spacing.
8. Posts shall be installed behind guard rail posts where there is guard rail installed along the highway.
9. Where, under normal spacing, a delineator post falls within a crossroad, that post may be moved in either direction a distance not to exceed one quarter of the normal spacing.
10. The values in the table were figured from the formula, $SPACING = 3\sqrt{Radius-50}$. Spacing for curves of greater degrees of curvature may be computed using this formula. The minimum permitted spacing is 25 feet.

State Highway Commission
Helena, Montana

5" - WOOD GUIDE POST

Approved

State Highway Engineer



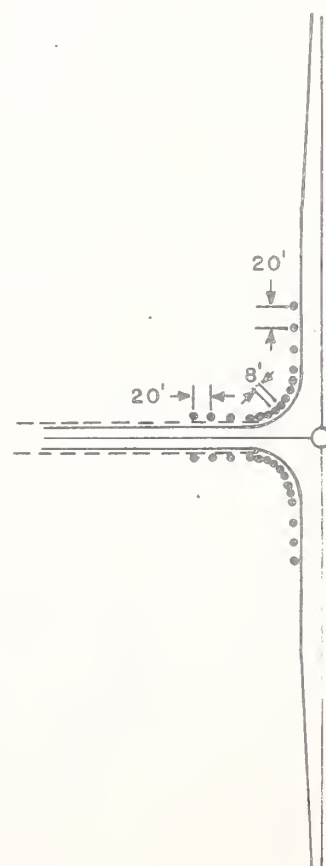
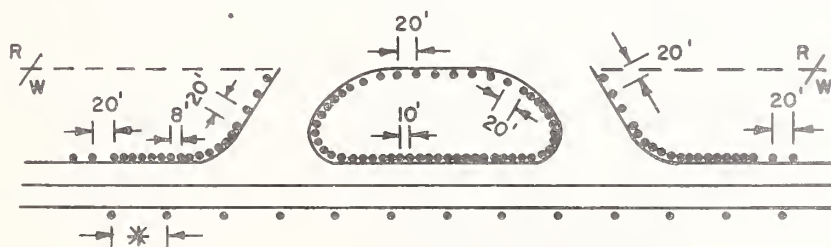
NOTES:

GUIDE POSTS TO BE OF 5" DIAMETER. WOOD POLE THAT CONFORMS TO THE APPLICABLE PROVISIONS OF THE STANDARD SPECIFICATIONS FOR ROAD & BRIDGE CONSTRUCTION. THE POLE SHALL BE TREATED IN SUCH A MANNER & WITH SUCH PRESERVATIVES THAT WILL ALLOW PAINT TO READILY ADHERE WITHOUT DISCOLORATION. (M-270.06(A)). THE PORTION ABOVE GROUND SHALL BE PAINTED WITH TWO COATS OF WHITE PAINT (M-280.01). REFLECTORIZATION OF GUIDE POSTS, IF REQUIRED IN PLAN SPECIFICATIONS, CAN BE ACCOMPLISHED BY APPLYING WHITE REFLECTORIZED PAINT ON TOP 6 INCH PORTION - OR - INSTALLATION OF DELINEATOR CRYSTALS AS SPECIFIED.

POST SPACING TO BE AS FOLLOWS:

RADII	SHLD. TANG. *	R/W TANG.
8'	10'	20'
C TO C	C TO C	C TO C

* DISTANCE VARIES - WILL BE NOTED IN PLANS



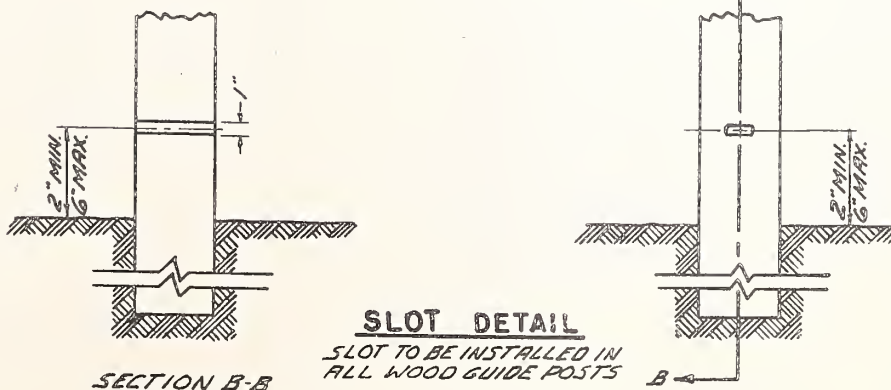
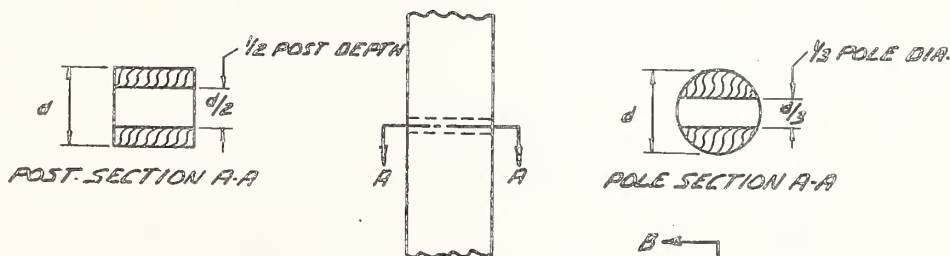
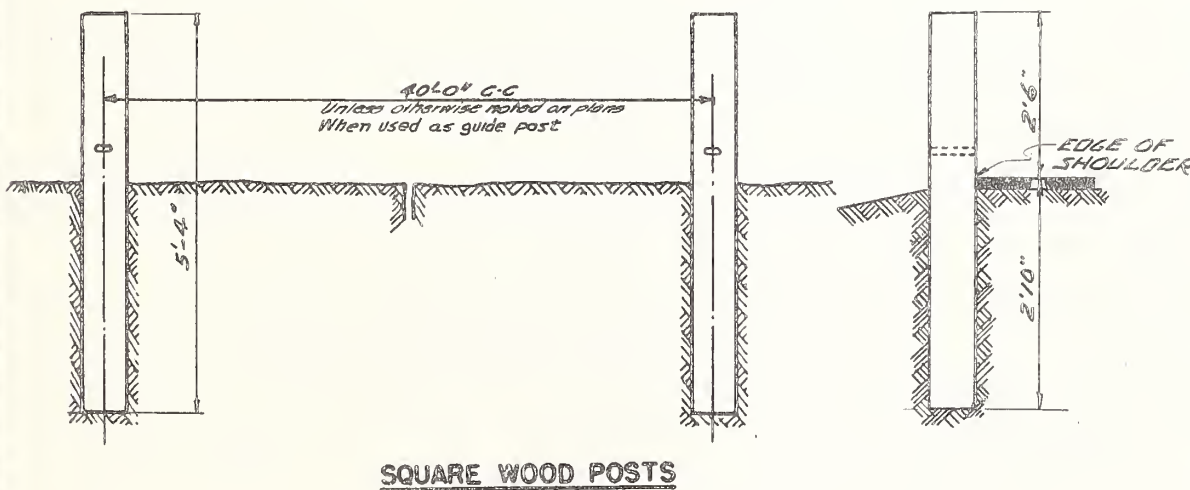
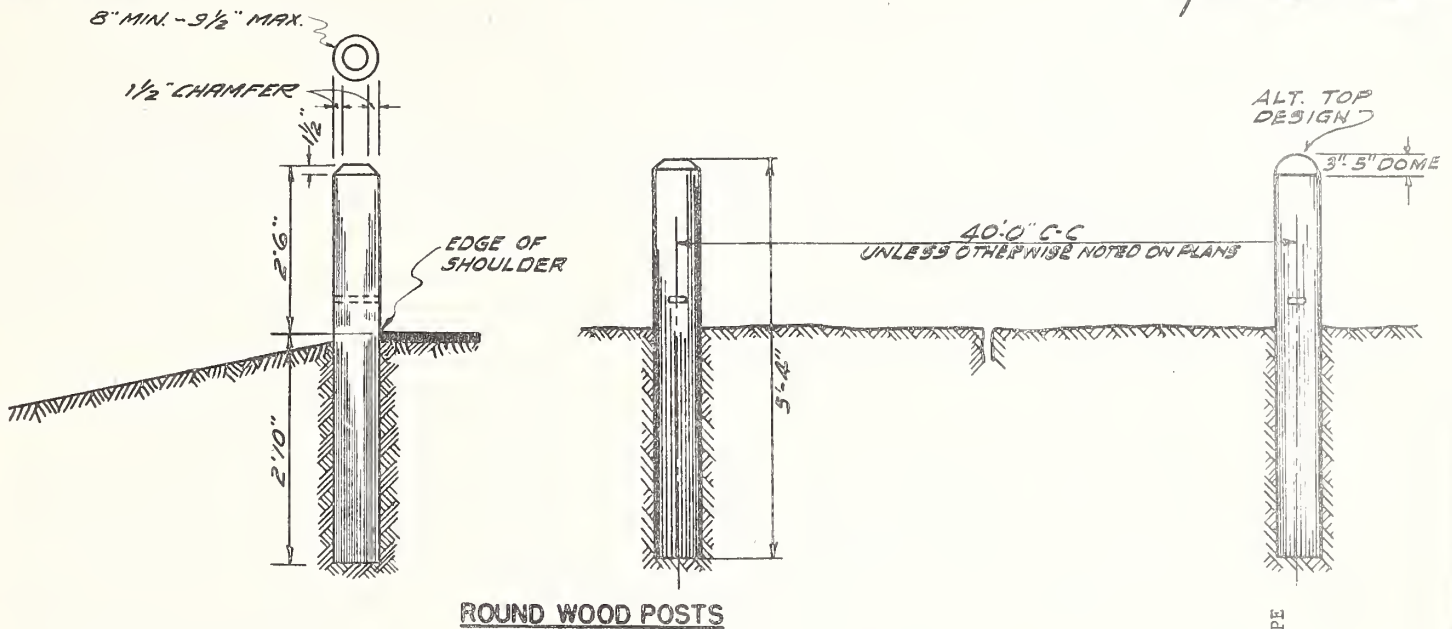
REVISED 9-1-67 11-22-68
EFFECTIVE 2-1-68 1-1-69

STANDARD DRAWING NO. 90-01

State Highway Commission
Helena, Montana

WOOD GUIDE POSTS

Approved
Jewell Outlin
State Highway Engineer

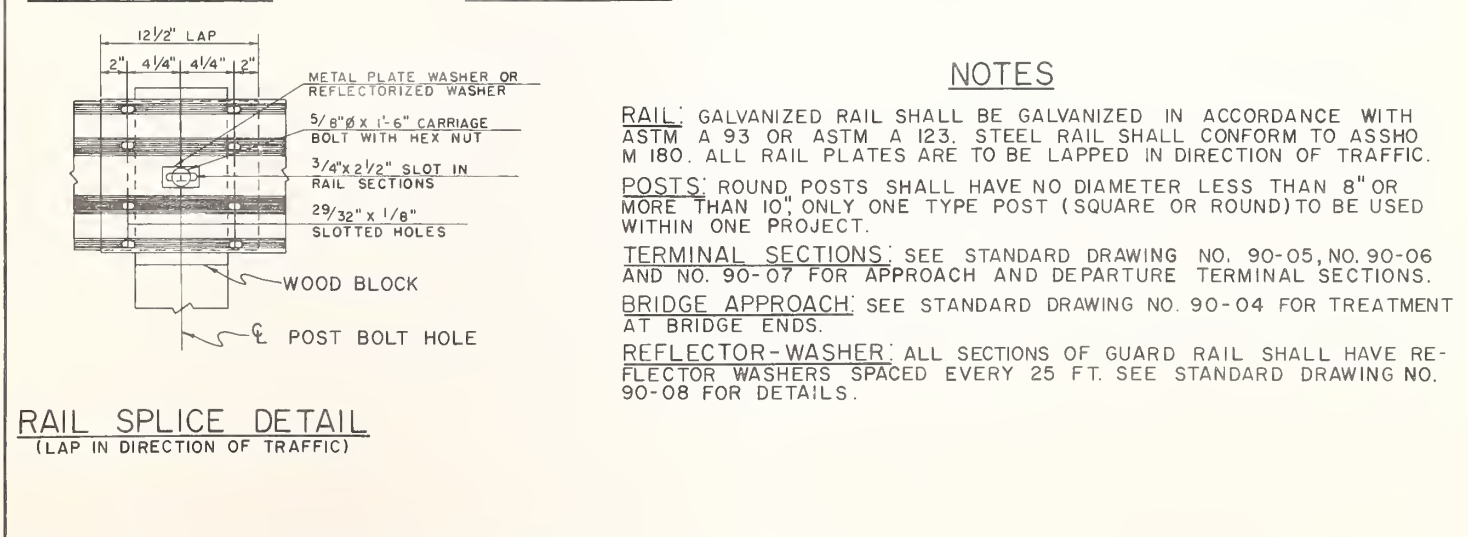
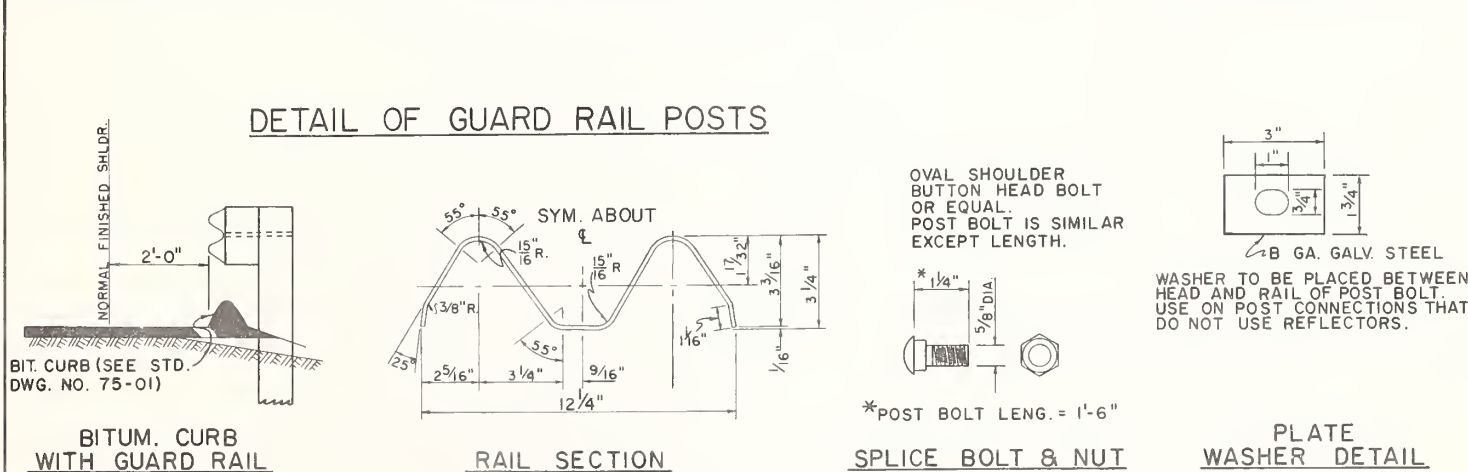
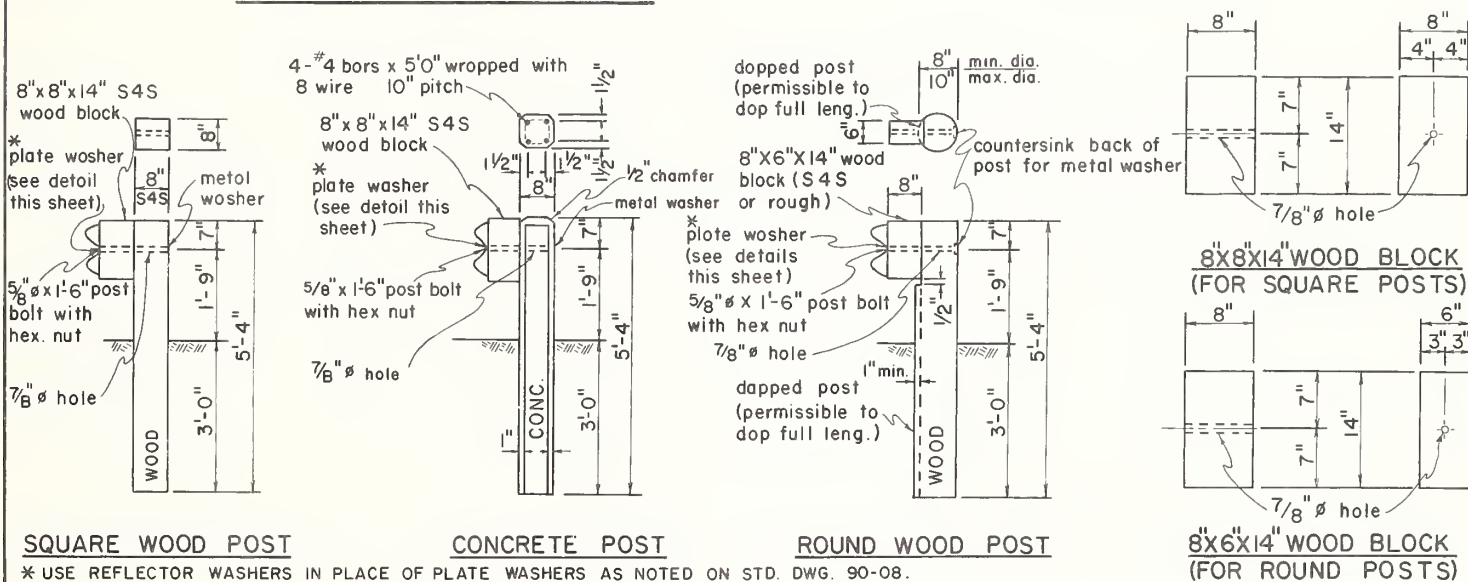
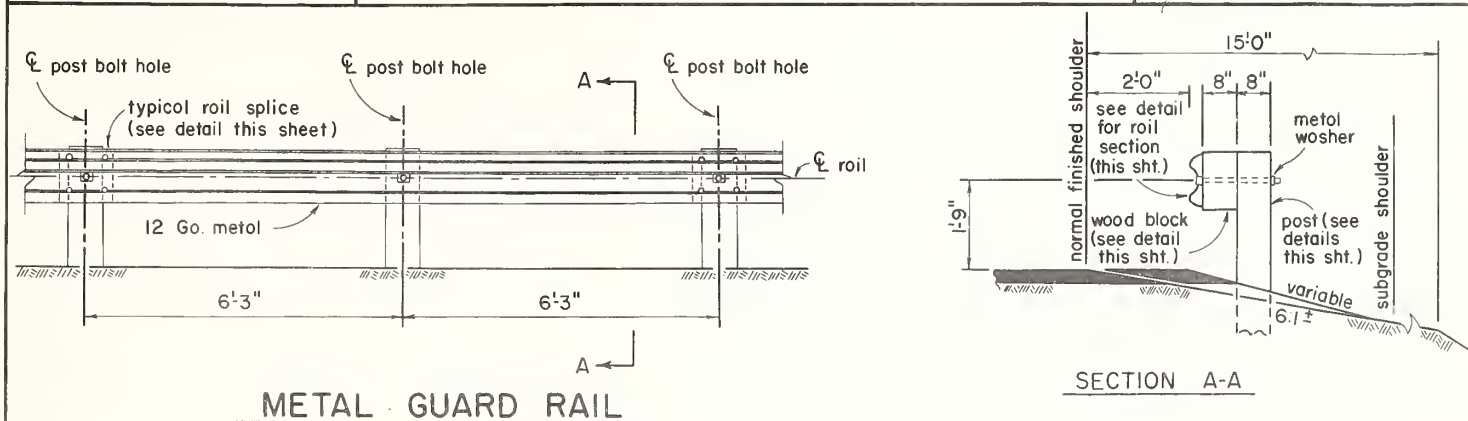


SUPPLIER MAY HAVE CHOICE OF TOP FINISH OF ROUND POSTS.
ALL POSTS FURNISHED ON ONE CONTRACT SHALL HAVE SAME TYPE OF TOP DESIGN.

REFLECTORIZATION OF GUIDE POSTS WILL BE DONE BY STATE FORCES, UNLESS OTHERWISE SPECIFIED.

WOOD POSTS SHALL BE OF DOUGLAS FIR, PONDEROSA PINE, NORTHERN WHITE CEDAR, WESTERN RED CEDAR, LARCH OR LODGEPOLE PINE. POSTS SHALL BE STRAIGHT, SOUND AND FREE FROM DEFECTS OF ALL KINDS, AND SHALL BE CUT FROM LIVE TREES NOT LESS THAN 30 DAYS, NOR MORE THAN 1 YEAR IN ADVANCE OF USE. ALL BARK SHALL BE PEELLED AND THE POSTS TRIMMED SMOOTH OF ALL KNOTS AND PROJECTIONS.

WOOD POSTS SHALL BE PRESSURE TREATED WITH PENTACHLOROPHENOL IN ACCORDANCE WITH THE STANDARD SPECIFICATIONS.



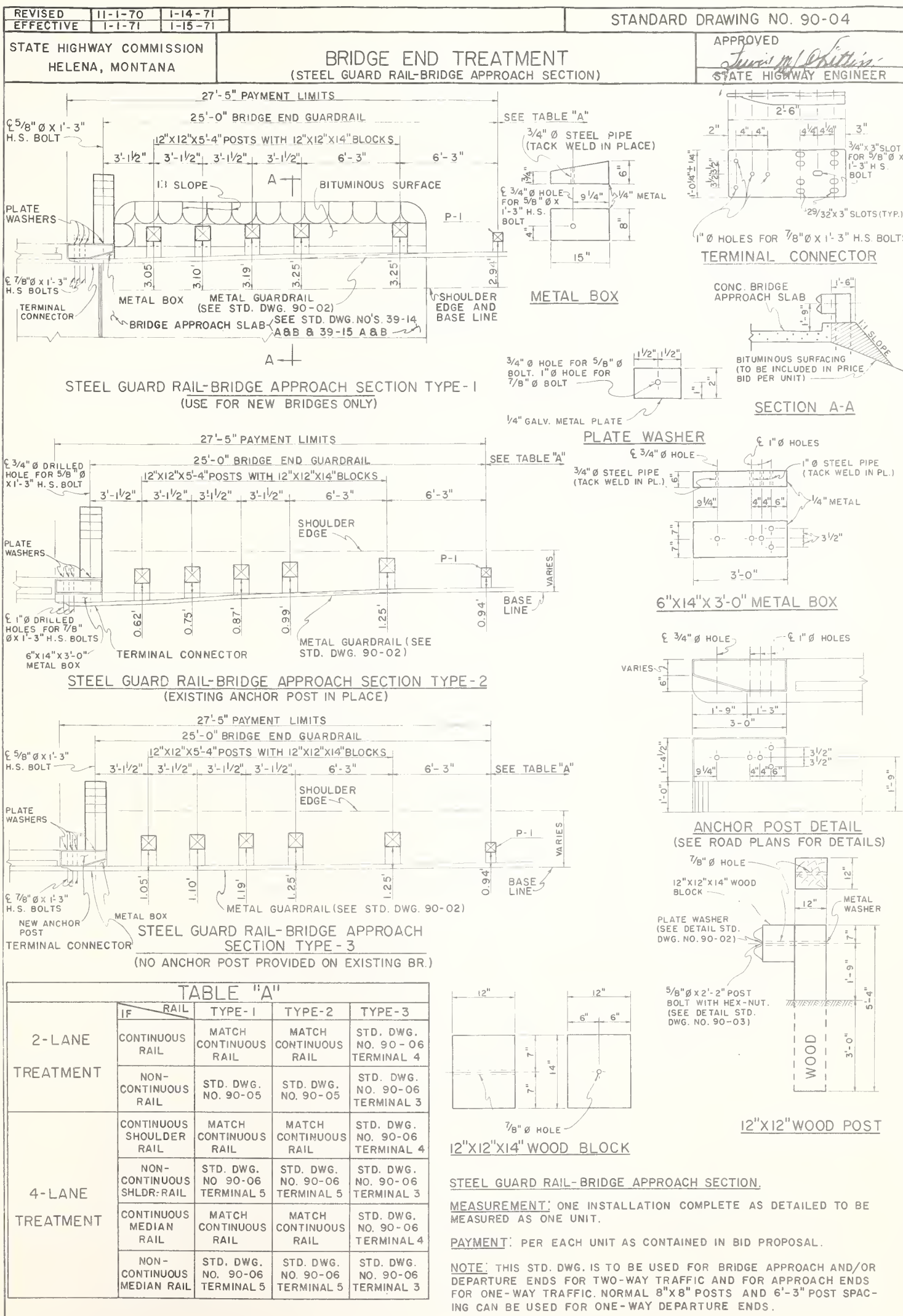
STANDARD DRAWING NO. 90-03

STATE HIGHWAY ENGINEER



WOOD BLOCK
DETAIL

REFLECTOR WASHER: ALL SECTIONS OF GUARDRAIL SHALL HAVE REFLECTOR - WASHERS SPACED EVERY 25 FT. SEE STD. DWG. NO. 90-08 FOR DETAILS.



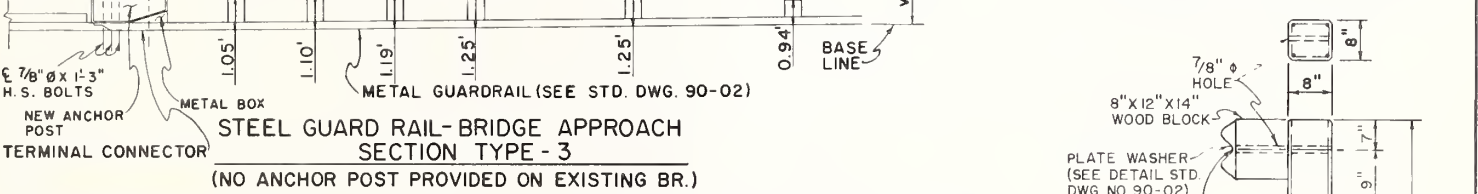
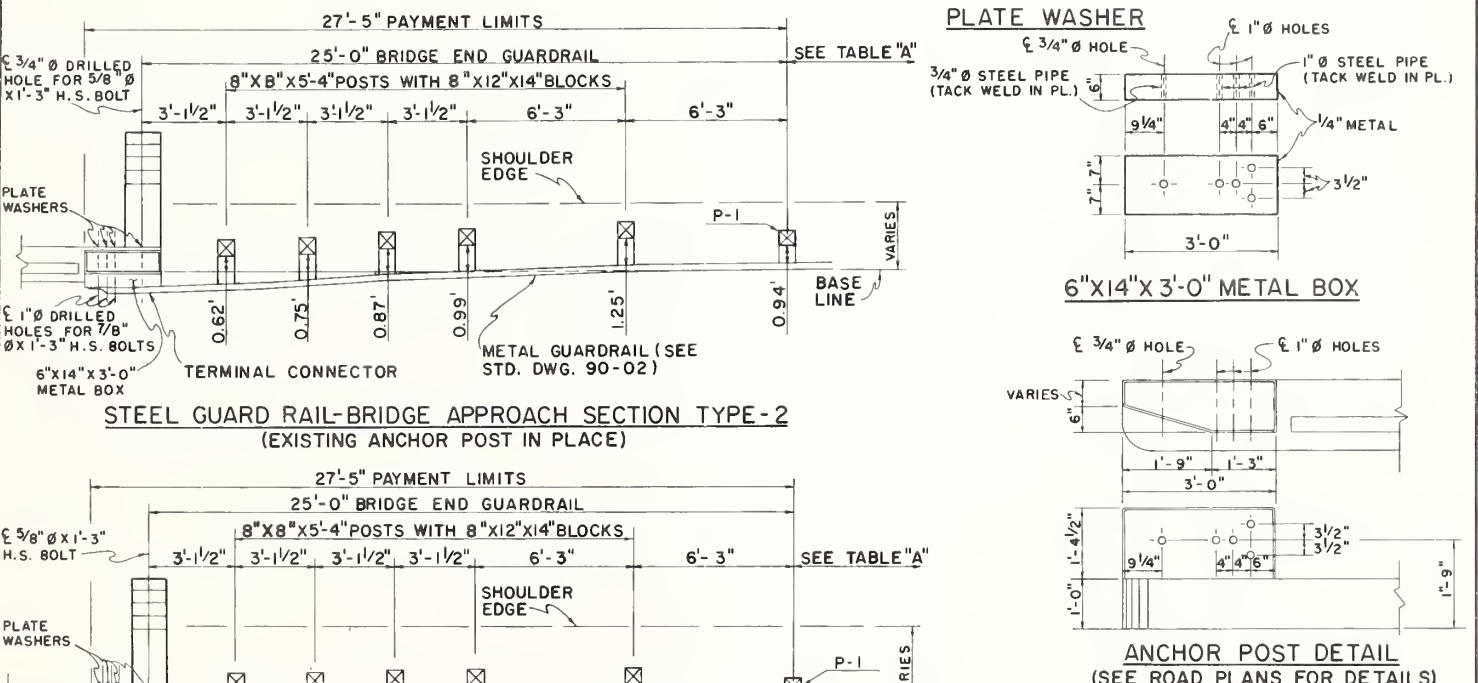
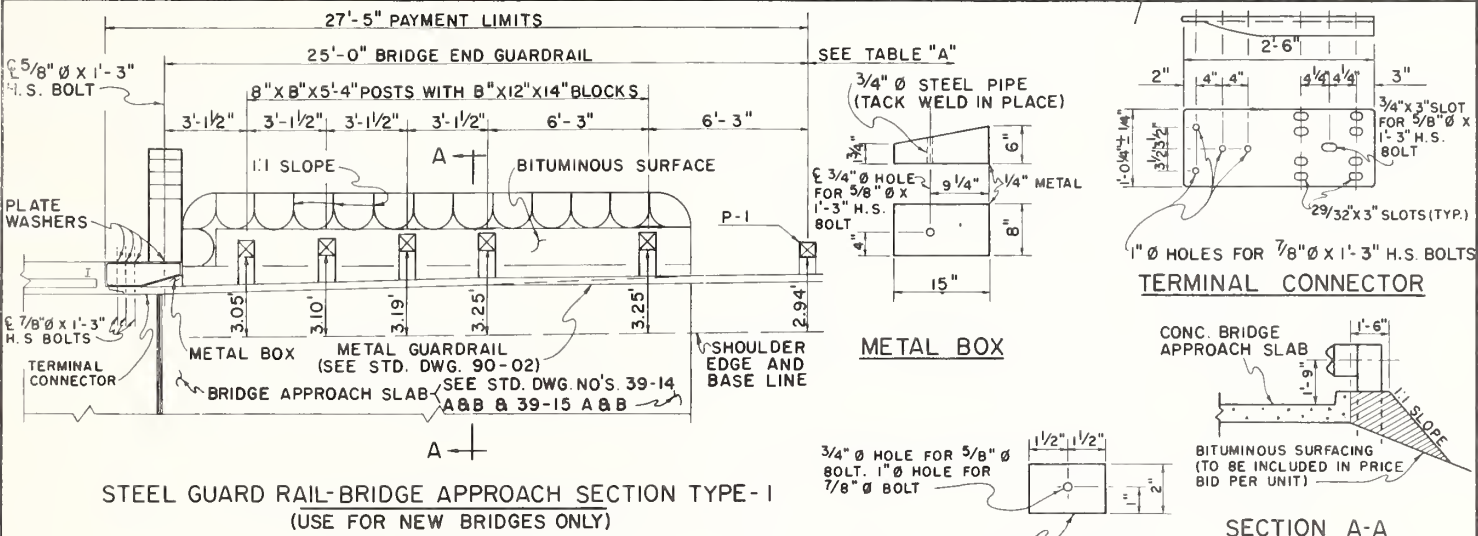
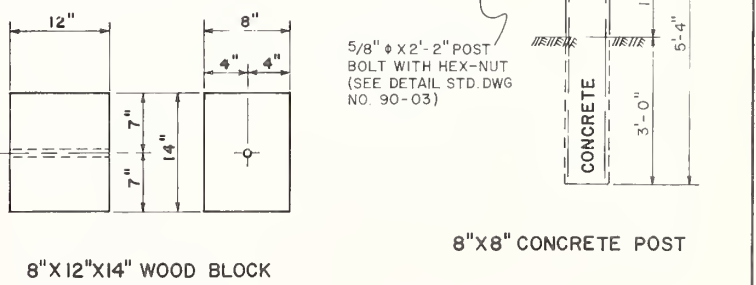


TABLE "A"				
	IF RAIL	TYPE-1	TYPE-2	TYPE-3
2-LANE TREATMENT	CONTINUOUS RAIL	MATCH CONTINUOUS RAIL	MATCH CONTINUOUS RAIL	STD. DWG. NO. 90-06 TERMINAL 4
	NON-CONTINUOUS RAIL	STD. DWG. NO. 90-05	STD. DWG. NO. 90-05	STD. DWG. NO. 90-06 TERMINAL 3
4-LANE TREATMENT	CONTINUOUS SHOULDER RAIL	MATCH CONTINUOUS RAIL	MATCH CONTINUOUS RAIL	STD. DWG. NO. 90-06 TERMINAL 4
	NON-CONTINUOUS SHLDR. RAIL	STD. DWG. NO. 90-06 TERMINAL 5	STD. DWG. NO. 90-06 TERMINAL 5	STD. DWG. NO. 90-06 TERMINAL 3
	CONTINUOUS MEDIAN RAIL	MATCH CONTINUOUS RAIL	MATCH CONTINUOUS RAIL	STD. DWG. NO. 90-06 TERMINAL 4
	NON-CONTINUOUS MEDIAN RAIL	STD. DWG. NO. 90-06 TERMINAL 5	STD. DWG. NO. 90-06 TERMINAL 5	STD. DWG. NO. 90-06 TERMINAL 3



STEEL GUARD RAIL-BRIDGE APPROACH SECTION.

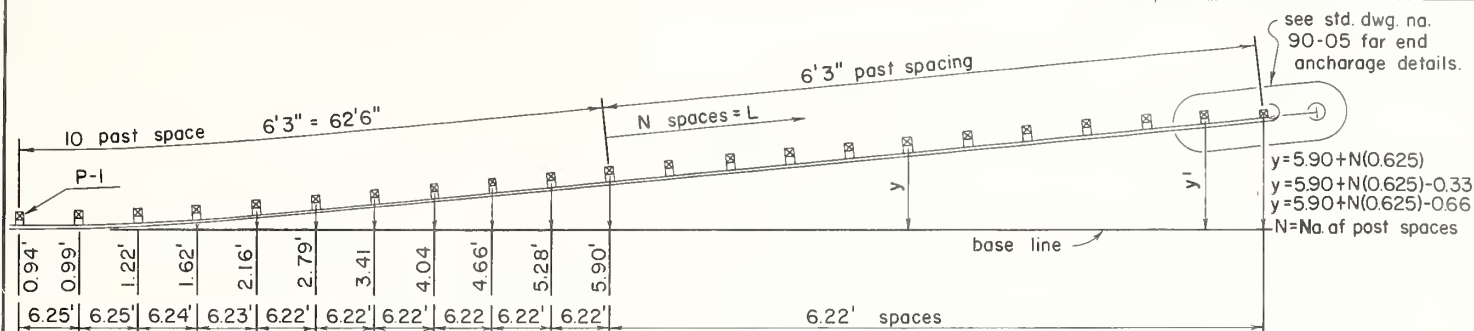
MEASUREMENT: ONE INSTALLATION COMPLETE AS DETAILED TO BE MEASURED AS ONE UNIT.

PAYMENT: PER EACH UNIT AS CONTAINED IN BID PROPOSAL.

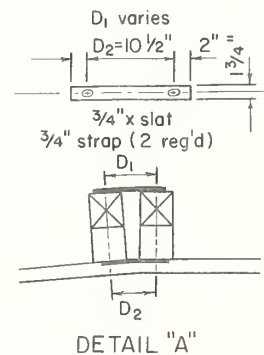
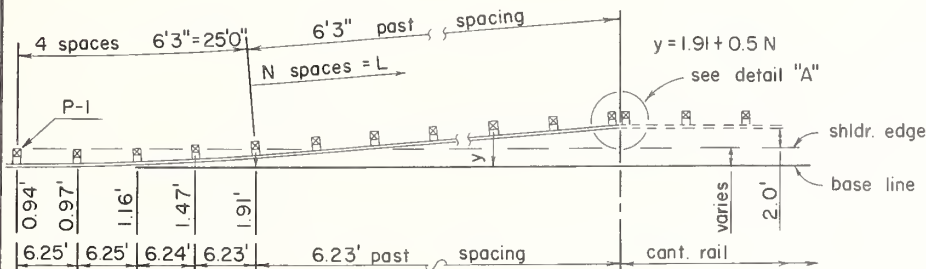
NOTE: THIS STD. DWG. IS TO BE USED FOR BRIDGE APPROACH AND/OR DEPARTURE ENDS FOR TWO-WAY TRAFFIC AND FOR APPROACH ENDS FOR ONE-WAY TRAFFIC. NORMAL 8"X8" POSTS AND 6'-3" POST SPACING CAN BE USED FOR ONE-WAY DEPARTURE ENDS.

STATE HIGHWAY ENGINEER





TERMINAL SECTION 3

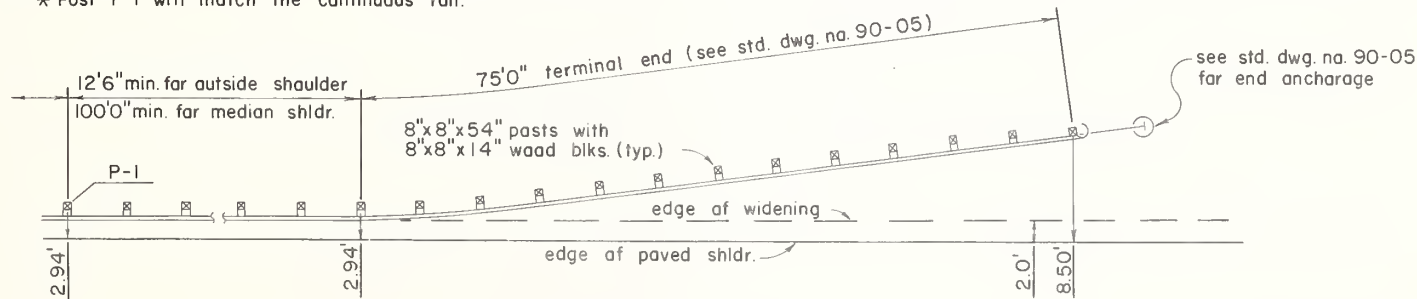


TERMINAL SECTION 4

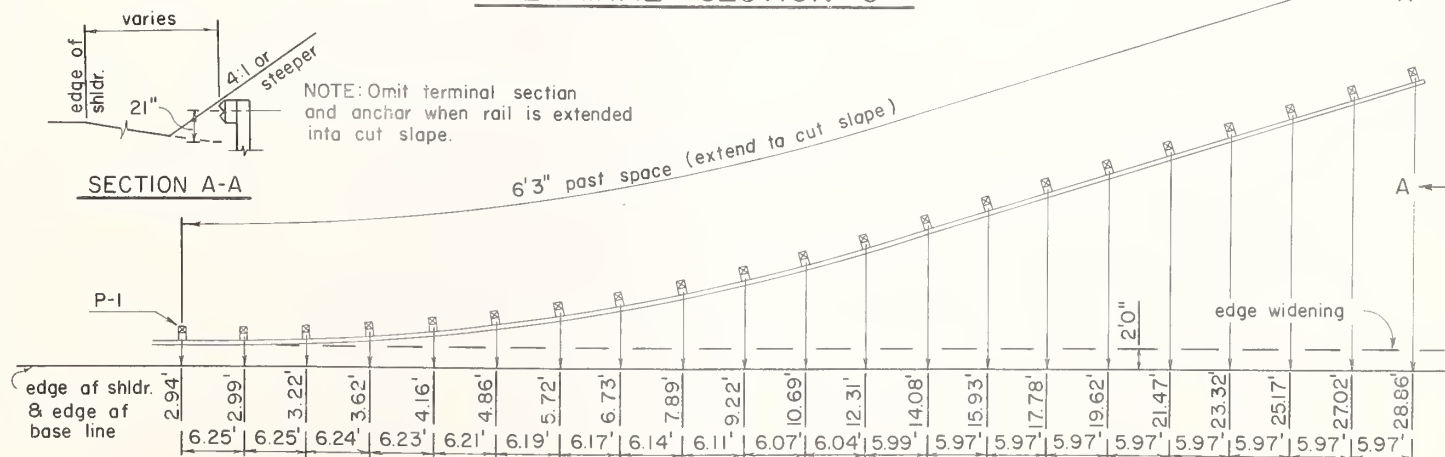
TABLE "B"

BRIDGE WIDTH (FT.)	28'								30'								32'								34'								36'								38'								40'								44'
ROADWAY WIDTH (FT.)	24	26	28	30	34	36	38	40	44	26	28	30	34	36	38	40	44	28	30	34	36	38	40	44	30	34	36	38	40	44	36	38	40	44	38	40	44	40	44	44	40	44	44														
TERMINAL 3 (N spaces)	6	8	10	12	14	16	18	20	22	6	8	10	12	14	16	18	20	6	8	10	12	14	16	18	6	8	10	12	14	16	8	10	12	16	8	10	14	8	12	8	8	12	8														
TERMINAL 4 (N spaces)	*	0	2	4	8	10	12	14	18	*	0	2	6	8	10	12	16	*	0	4	6	8	10	14	*	2	4	6	8	12	2	4	6	10	2	4	8	2	6	2	6	2	6	2													

* Post P-1 will match the continuous rail.

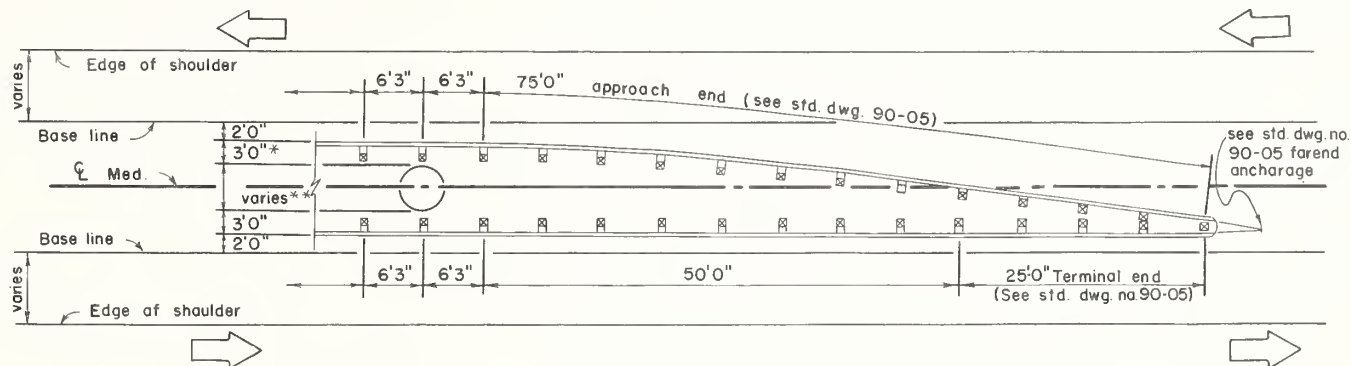


TERMINAL SECTION 5



TERMINAL SECTION 6

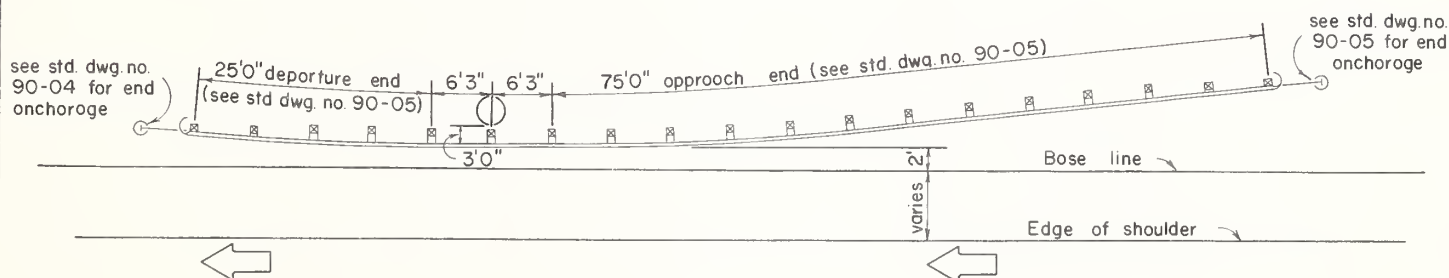
(This Terminal Section to be used for cut slope embedment)



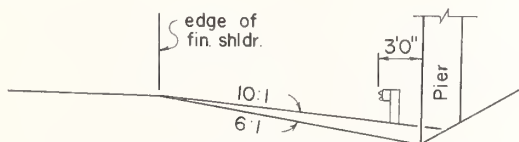
MEDIAN BRIDGE PIER TREATMENT

* This dimension may be greater if pier footings interfere with the guardrail post or if continuous rail is provided on the shoulder.

** When pier width is greater than 3'0", adjust the last eight post offsets of the 75' terminal section to fit the condition.



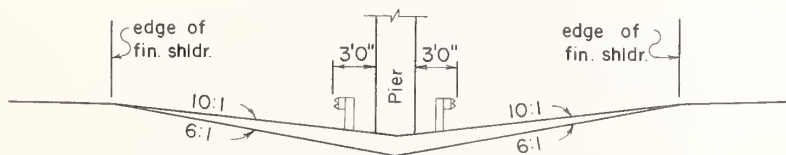
OUTSIDE SHLDR. BRIDGE PIER TREATMENT



OUTSIDE SHOULDER SLOPE

NOTE: Obstruction less than 30' from edge of nearest traffic lane require guardrail.

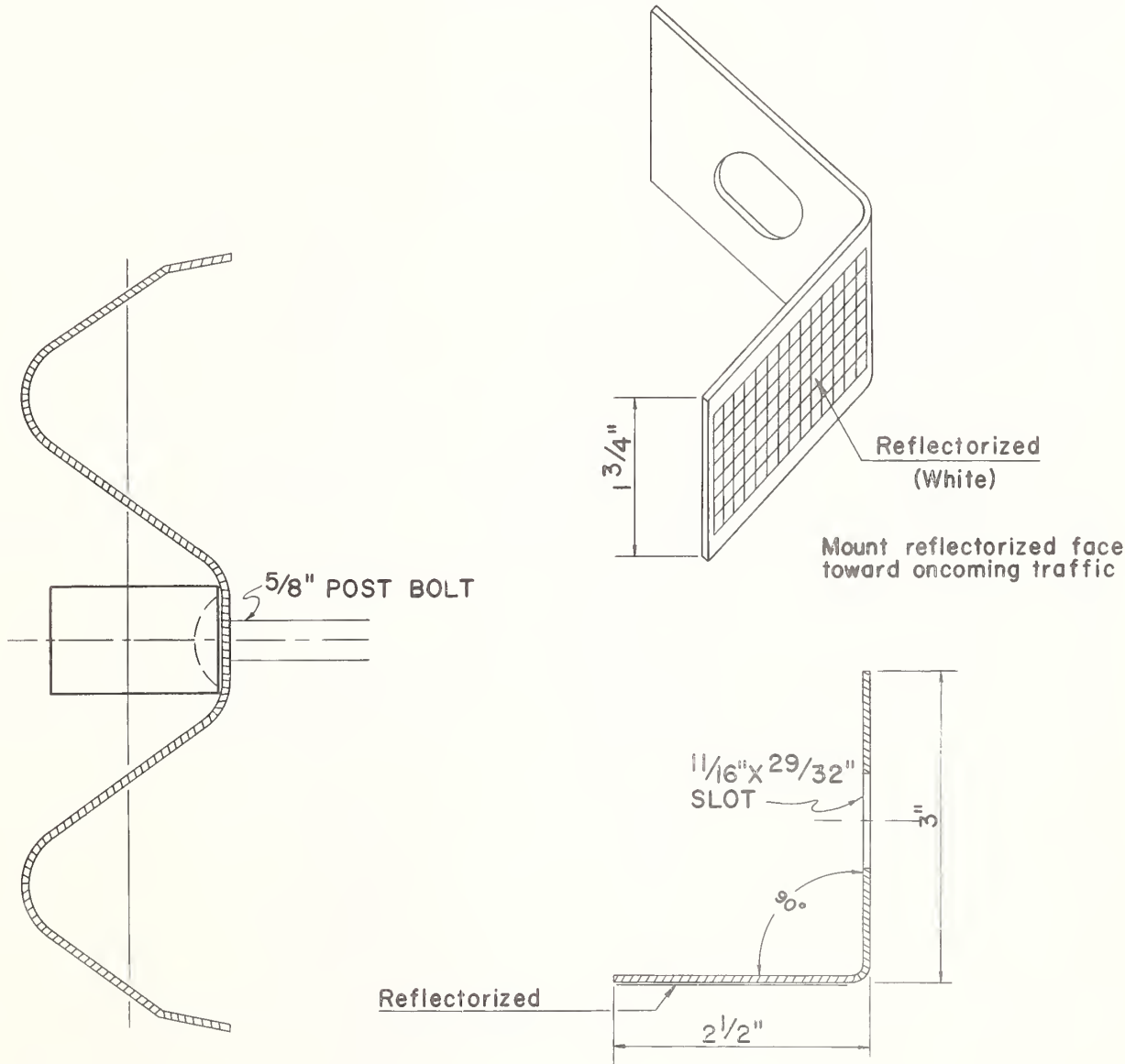
NOTE: When guardrail installations are more than 2 feet from the edge of the shoulder, the fill slope shall be a 10:1 slope beginning at the edge of finished shoulder.



MEDIAN SLOPE

REVISED	11-1-70		STANDARD DRAWING NO. 90-08
EFFECTIVE	1-1-71		
STATE HIGHWAY COMMISSION HELENA, MONTANA		REFLECTOR-WASHER	APPROVED <i>[Signature]</i> STATE HIGHWAY ENGINEER

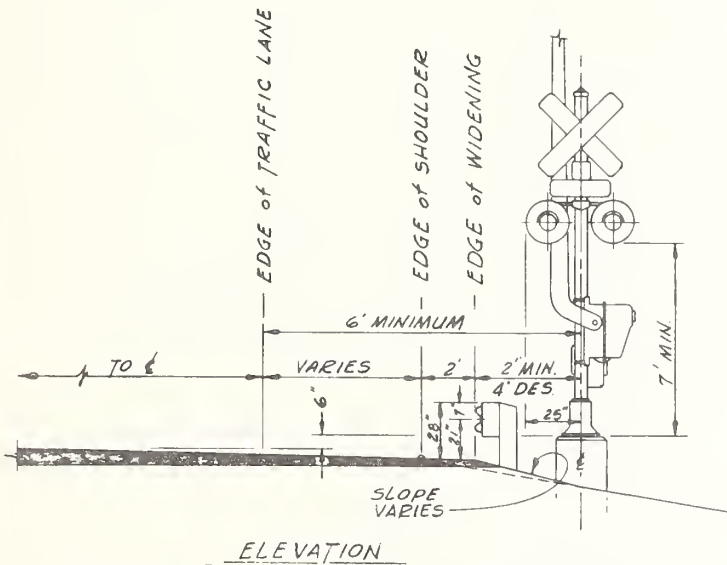
Material- 8 gage galvanized
approximate weight
0.47 lbs.



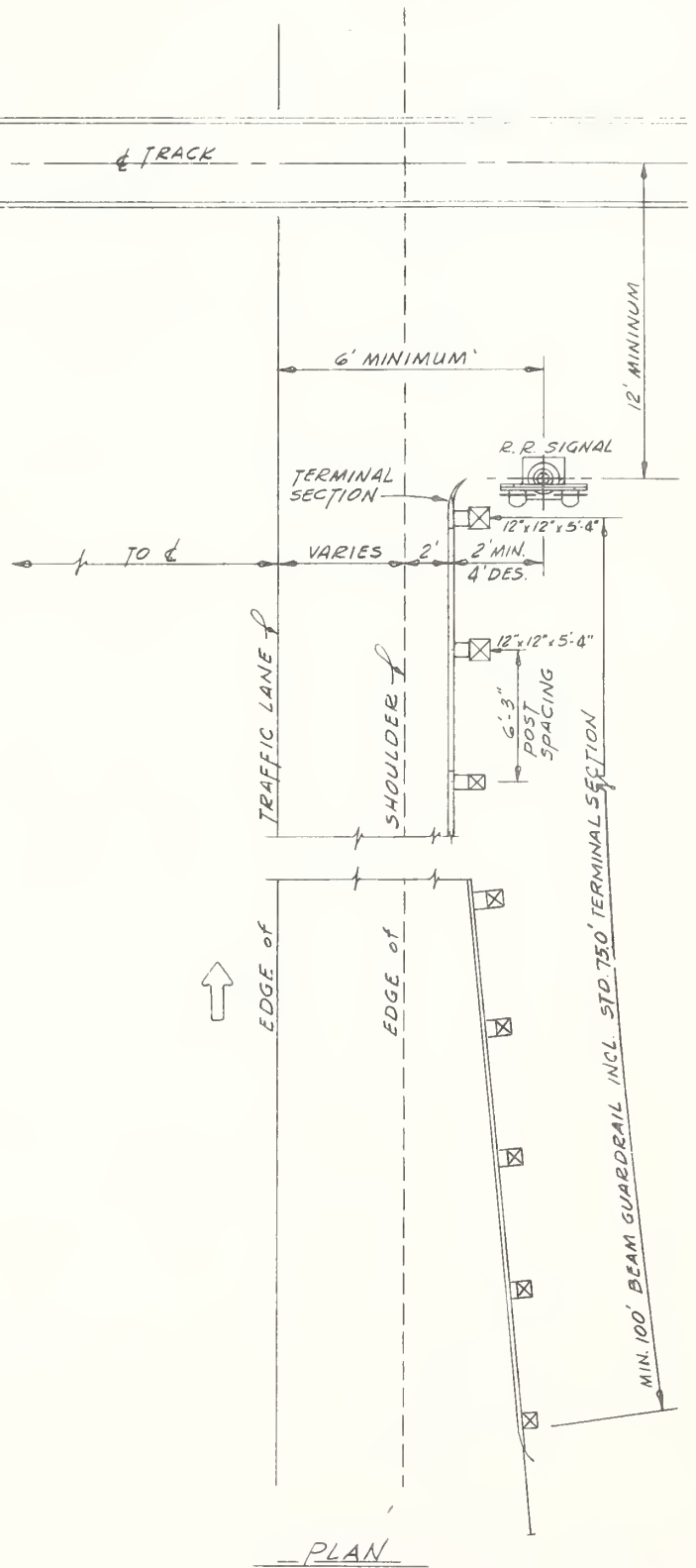
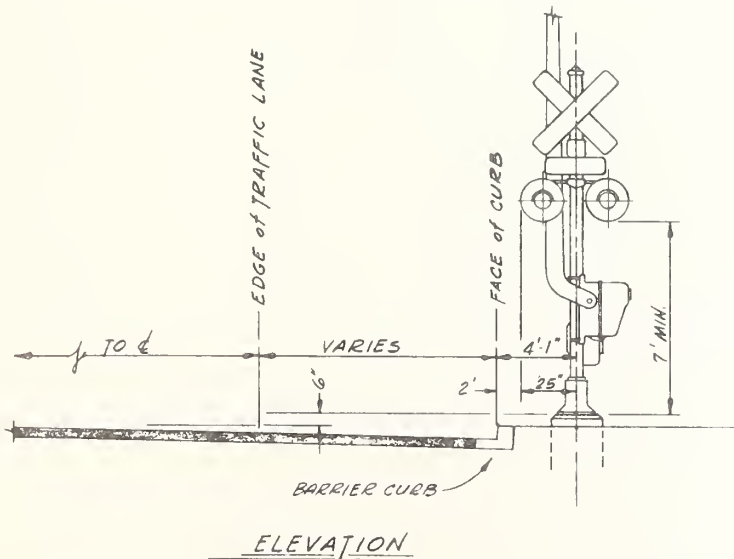
All sections of guard rail shall have reflector-washers installed every 25 ft. Reflector-washers are not required on bridge end, bridge pier or grade crossing protection guard-rail.

The use of reflectors will replace the need for the rectangular washers required to fasten rail to post.

Reflector-washers to be included in the unit price per linear foot of guard rail.



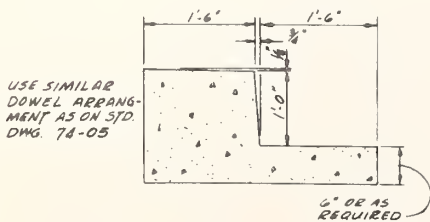
IN EVERY CASE WHERE THERE IS NO BARRIER TYPE CURB, GUARDRAIL SHALL BE INSTALLED UNLESS SUCH INSTALLATION IS FOUND TO BE IMPRACTICABLE.



NOTE -

SEE BULLETIN NO. 6, "RECOMMENDED PRACTICES FOR RAILROAD - HIGHWAY GRADE CROSSING PROTECTION", ASSOCIATION OF AMERICAN RAILROADS, FOR ADDITIONAL DETAILS & SKEWED CROSSINGS.

SEE STD. DWG 90-05 FOR TERMINAL SECTION DETAILS.



REVISED	6-1-67	11-1-68	5-20-69
EFFECTIVE	6-1-67	1-1-69	7-1-69

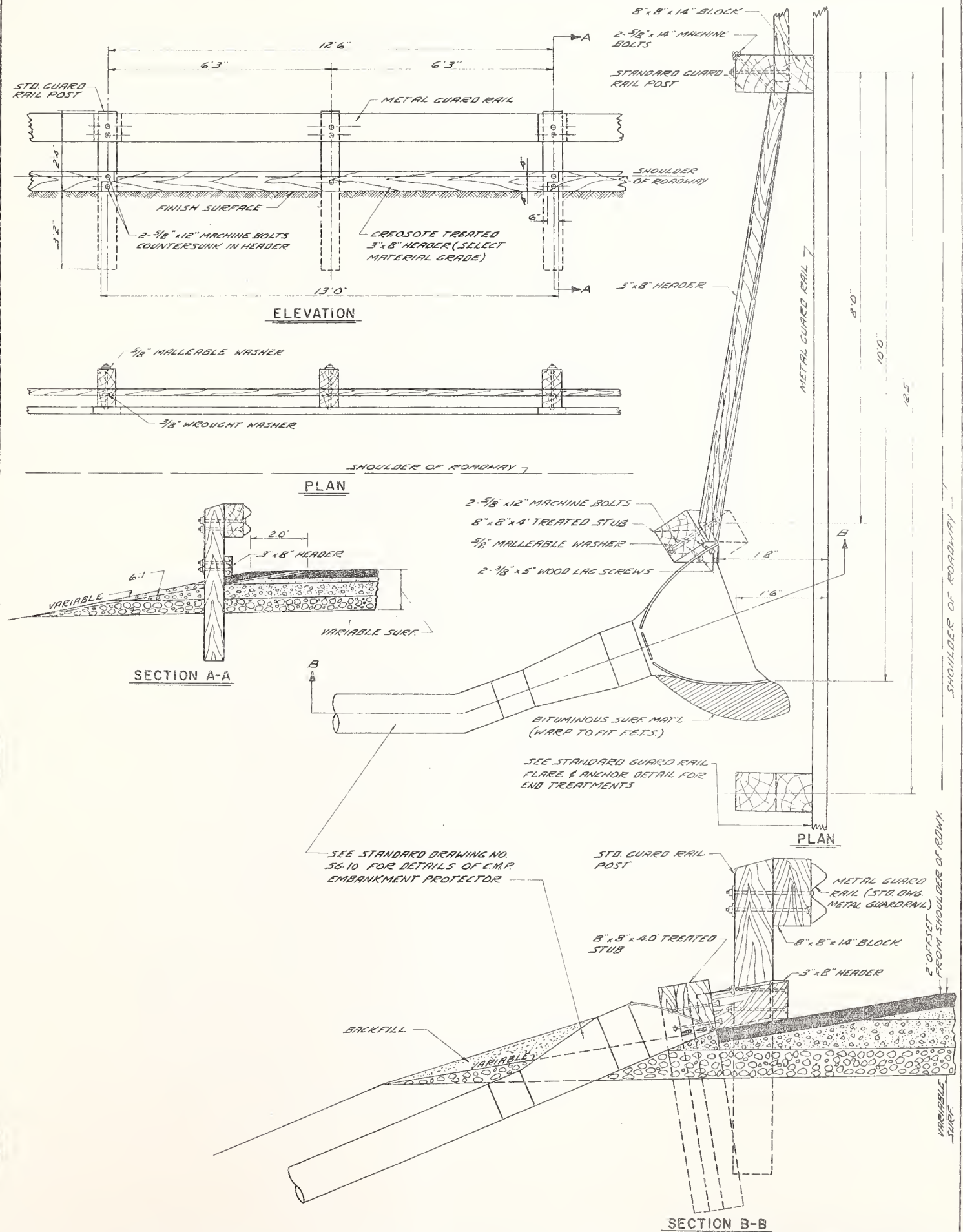
STANDARD DRAWING NO. 90-15

State Highway Commission
Helena, Montana

COMBINATION GUARD RAIL & HEADER

Approved 3/13/67

Levin M. Butcher
State Highway Engineer



REVISED	6-1-67	11-1-68
EFFECTIVE	6-1-67	1-1-69

STANDARD DRAWING NO 90-16

State Highway Commission
Helena, Montana

LAYOUT OF COMBINATION GUARD RAIL & HEADER

Approved 3/13/67

Lewis R. Patton
State Highway Engineer

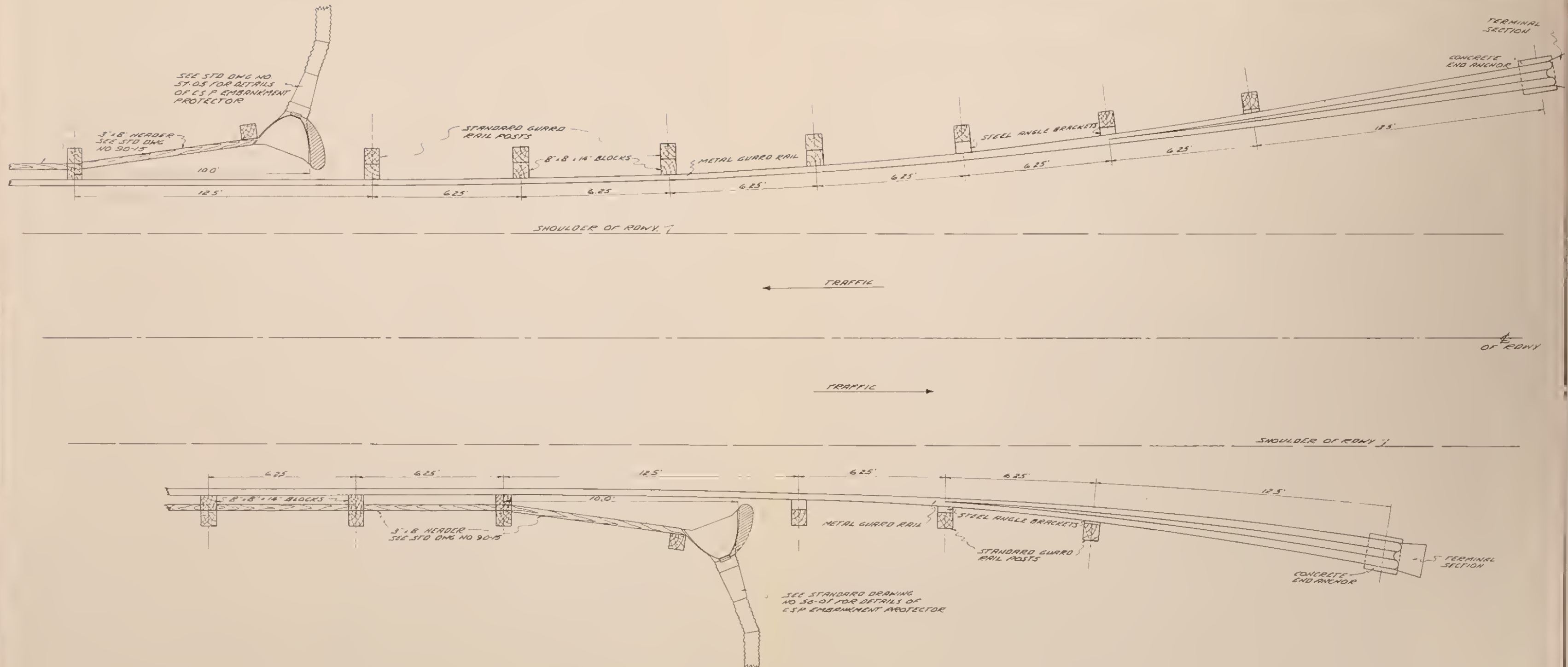
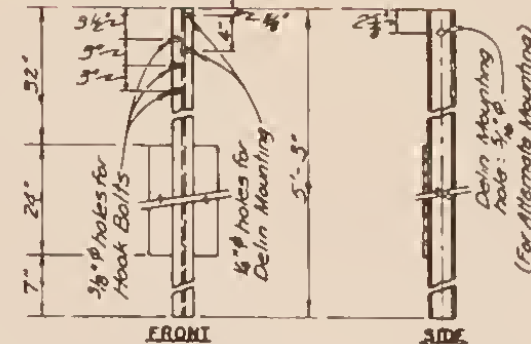
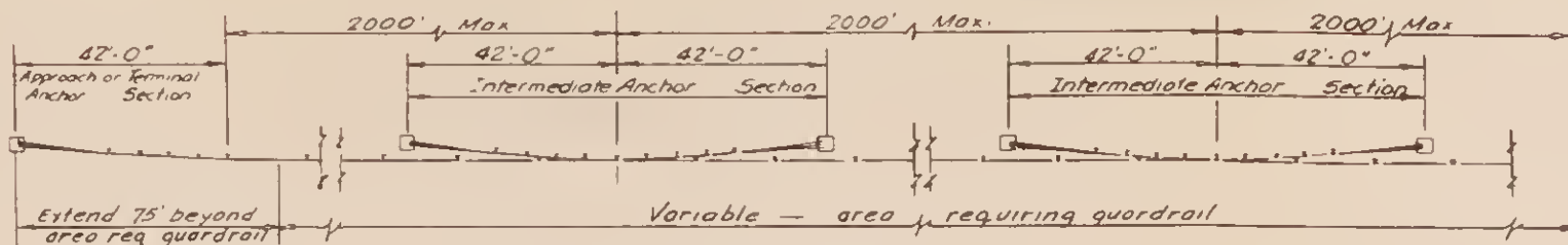
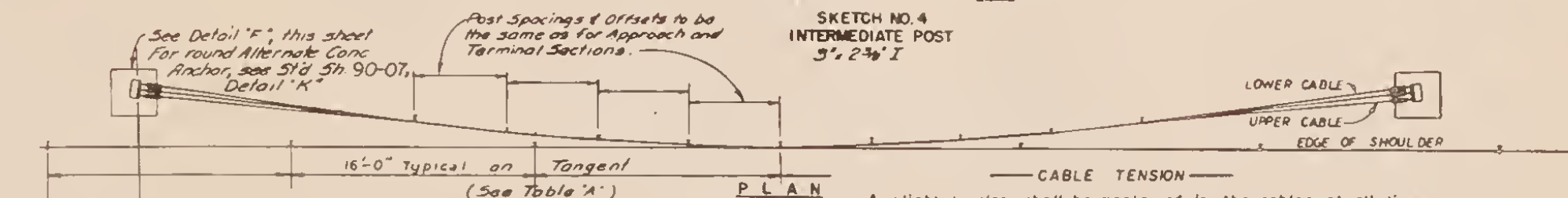
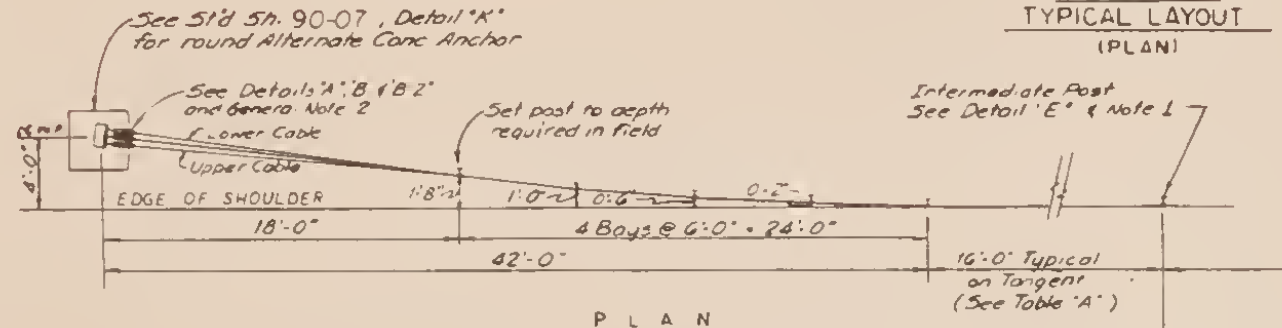


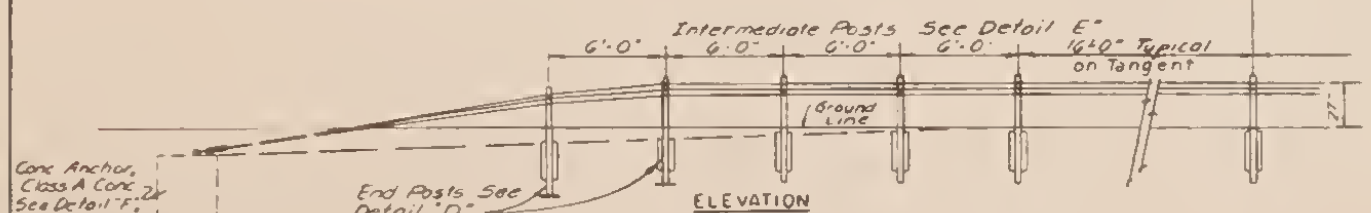
TABLE "A"	
CURVATURE (Degrees or Radius)	POST SPACING
5° or less	16'
More than 5° to 25°/120 ft. radius	12'
219 ft. to 111 ft.	6'
110 ft. to 76 ft.	4'
75 ft. to 50 ft.	3'
Less than 50 ft.	Use not recommended



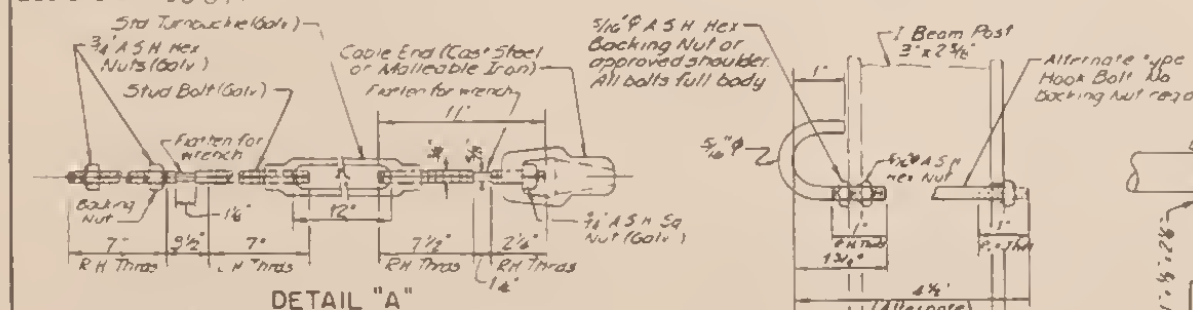
SKETCH OF
TYPICAL LAYOUT
(PLAN)



SKETCH NO. 4
INTERMEDIATE POST
9° 23' N

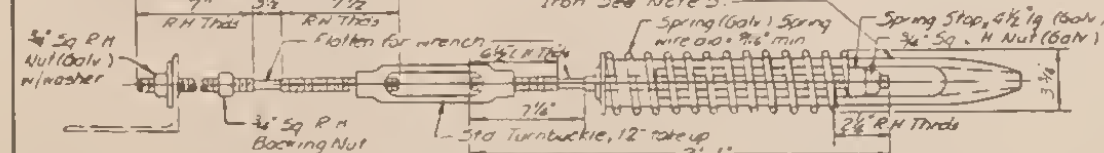


TYPICAL APPROACH & TERMINAL SECTIONS

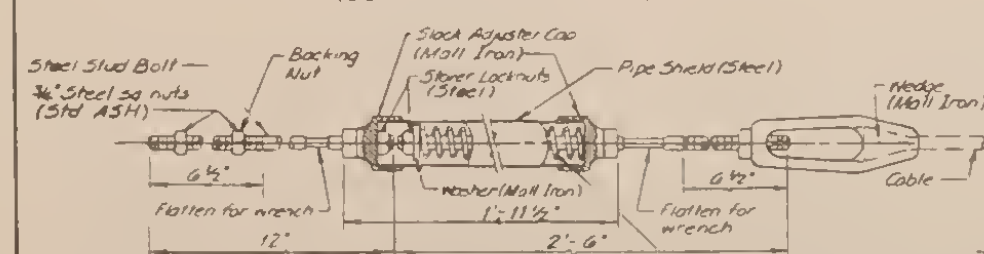


STEEL TURNBUCKLE CABLE END ASSEMBLY

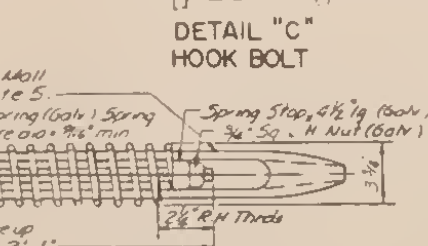
Minimum Torsion Strength: 25,000 lb-ft
1'-6" min: See "ELEVATION" on Std Sheet
90-07 Provide sufficient rad lghs for
side clearance between units 2



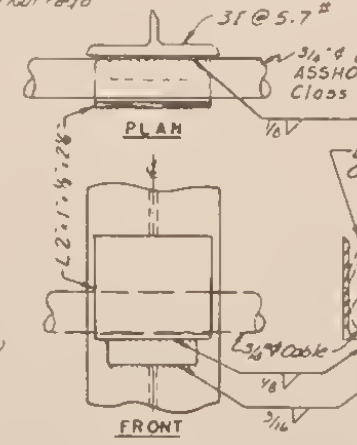
DETAIL "B"
SPRING CABLE END ASSEMBLY
(COMPENSATING DEVICE)



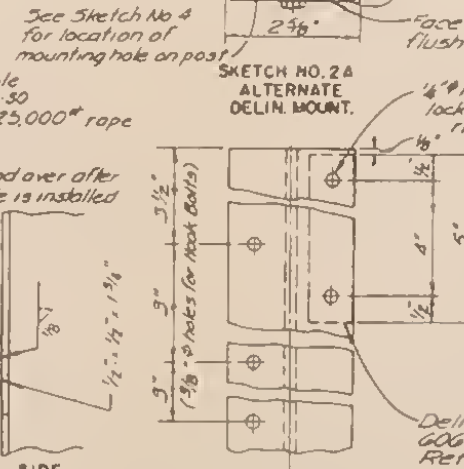
DETAIL "B-2"
(ALTERNATE) SPRING CABLE END ASSEMBLY
(COMPENSATING DEVICE)



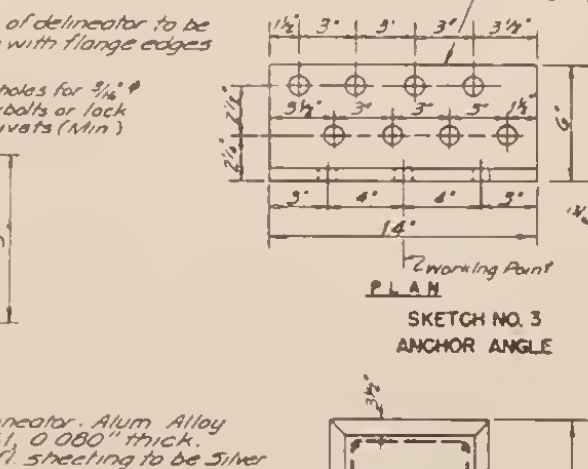
DETAIL "C"
HOOK BOLT



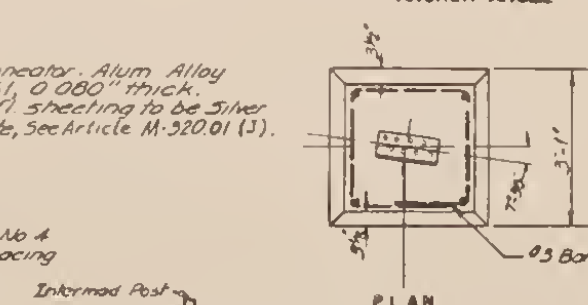
SKETCH NO. 1
CABLE MOUNTS
ON END POSTS



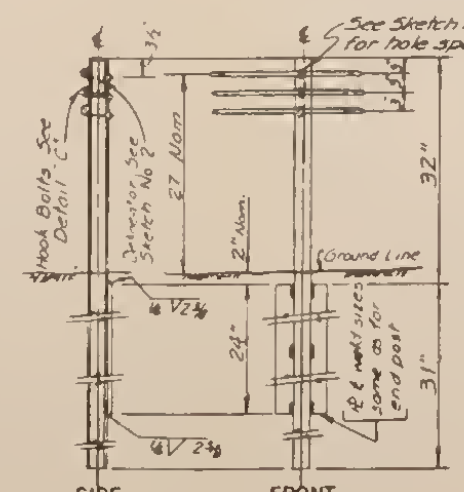
SKETCH NO. 2
DELINEATOR INSTALLATION



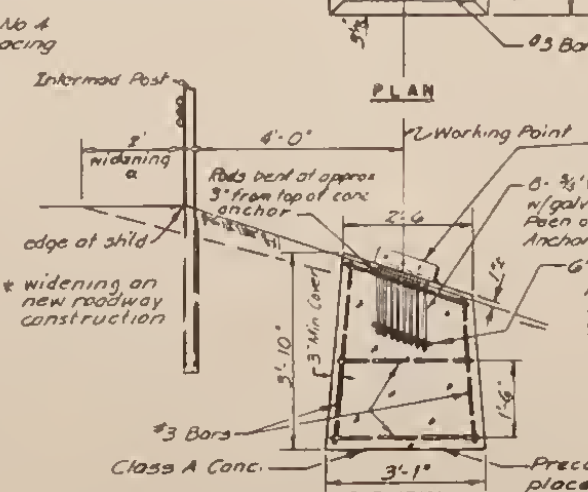
SKETCH NO. 3
ANCHOR ANGLE



PLAN



DETAIL "E"
INTERMEDIATE POST
3' x 2 3/4" I @ 5.7°



DETAIL "F"
CONCRETE ANCHOR
For Alternate Strong Box 5th Dr. 90-07

A slight tension shall be maintained in the cables at all times to prevent unsightly sag. Cables shall be uniformly tensioned as directed by the Engineer.

• GENERAL NOTES.

1. Intermediate posts shall be 3" x 2 3/4" I-Beams @ 5.70. Every other intermediate post that is parallel to the edge of port 1 shall be reinforced (See Sketch No.2) Do not reinforce posts in the TYPICAL APPROACH, TERMINAL and INTERMEDIATE ANCHOR SECTIONS.
2. For arrangement of Spring Cable End Assemblies (Compensating Devices) and Turnbuckle Cable End Assemblies, the following criteria shall apply:
 - Length of Cable Runs:
 - To 500' - Use Compensating Device on one end, and turnbuckle on other end of each individual cable.
 - Over 500' to 2000' - Use Compensating Device & turnbuckle on each end of each individual cable.
 - Over 2000' - Start new stretch by interlocking of last parallel post (See "Sketch of Typical Layout" above).
3. Cable Splices & Cable Ends shall be positive and of any type and design coinciding with the intent, design & strength of the structure and meeting with the approval of the Engineer.
4. Fittings :- All fittings shall be so designed and be of such section as to develop the full strength of a single cable or cable assemblies as the case may be.
 - Single Cable Assembly - Min. Tensile Strength = 25,000^{lb}.
 - Three Cable Anchor Assy = " " " = 100,000^{lb}.All fittings shall be galvanized in accordance with cable guardrail specifications.
5. Steel castings shall conform to the requirements of A.S.T.M. Designation A-27. All steel castings shall be Grade 65-35, full annealed. Material indicated as "Malleable Iron" shall conform to Std Spec. No. 280.17, malleable castings (Grade 38010).

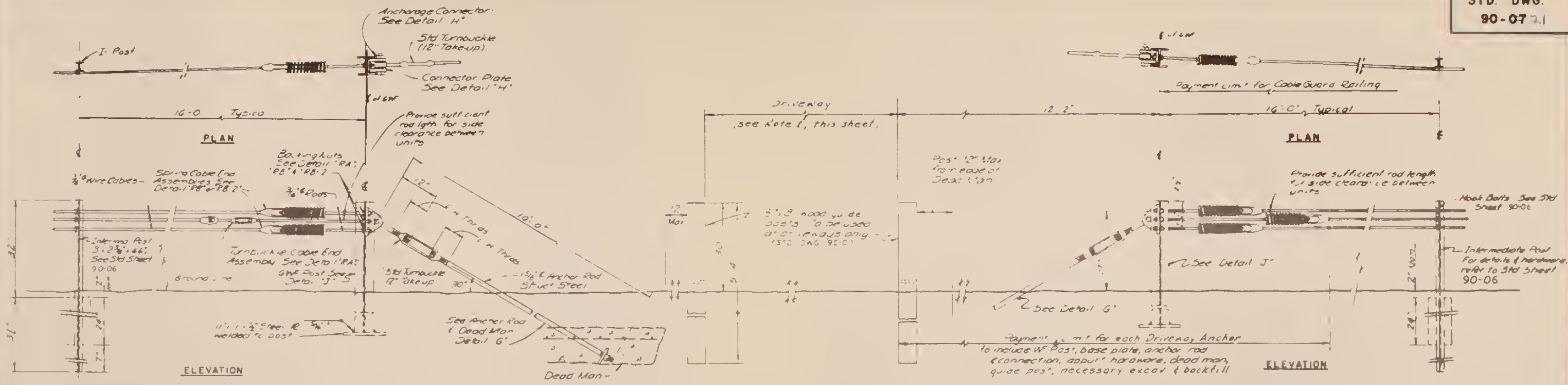
6. Hook bolts, as installed, shall develop an ultimate pull open strength of from 500⁰ to 1000⁰ applied in a direction normal to the longitudinal axis of the post.

7. Cable - $\frac{1}{4}$ " class A 25,000⁰ rope - ASSHO M-30.

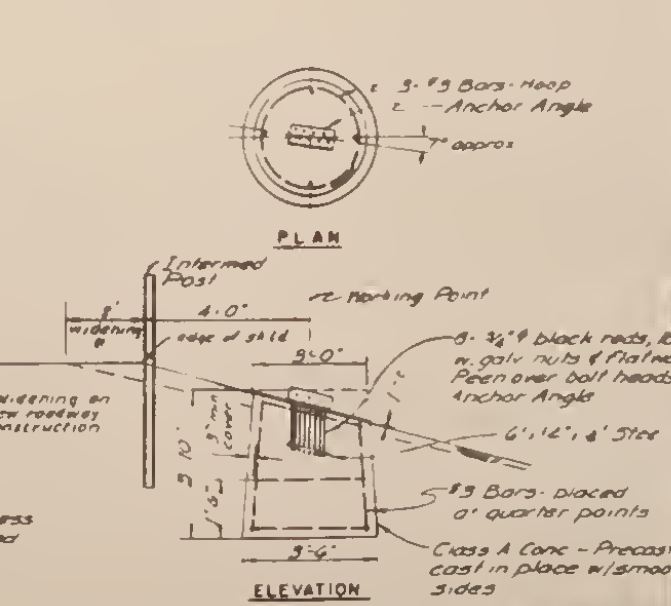
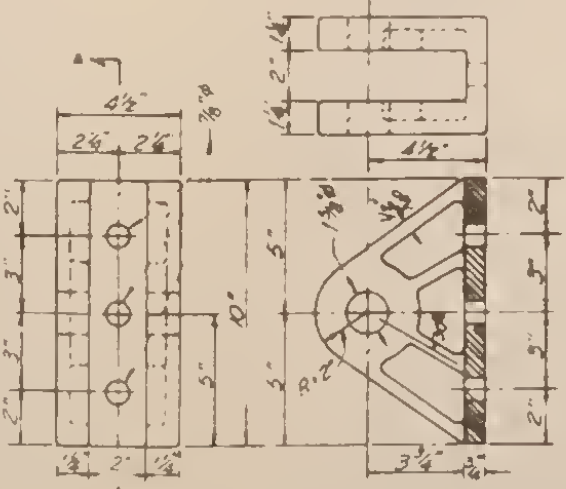
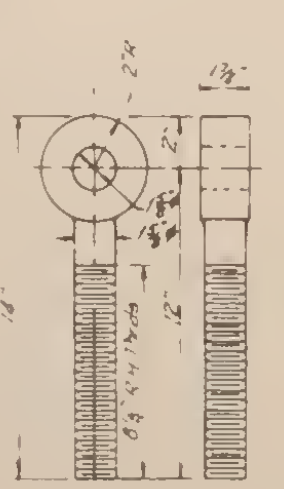
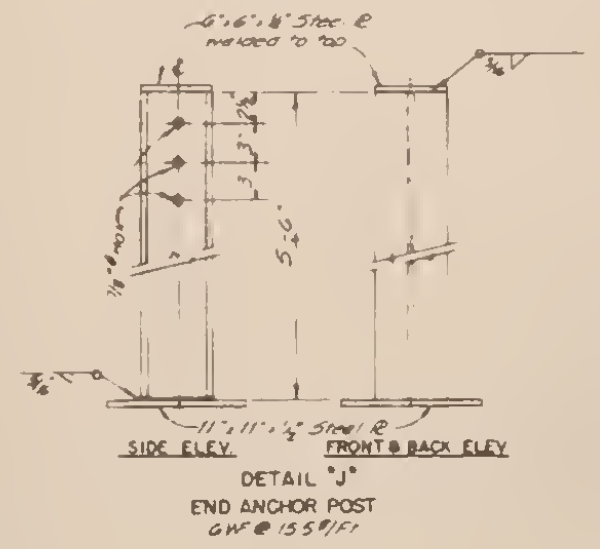
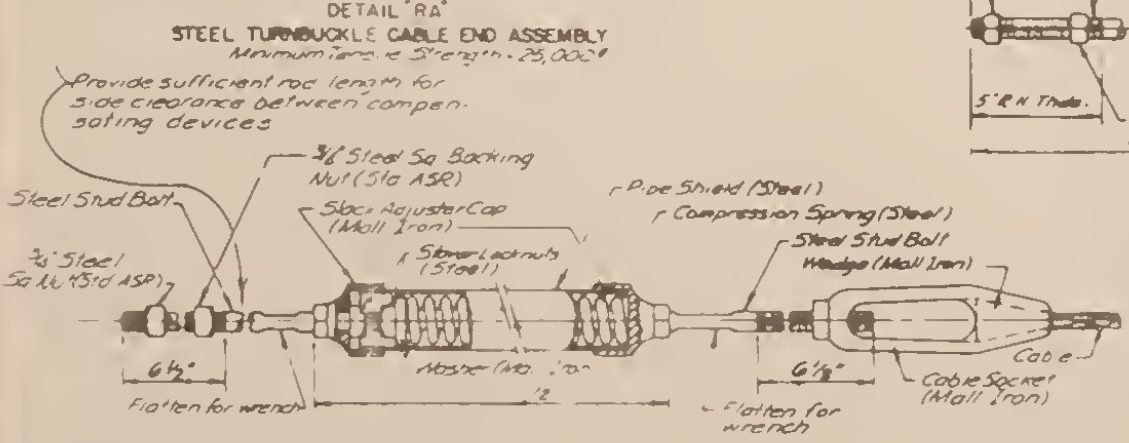
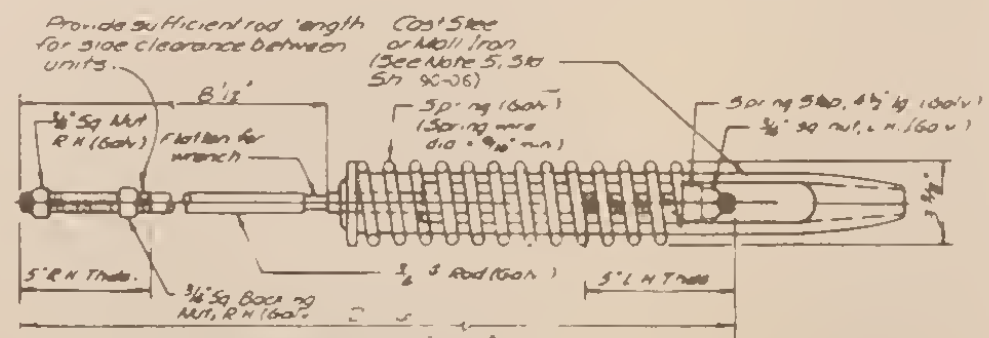
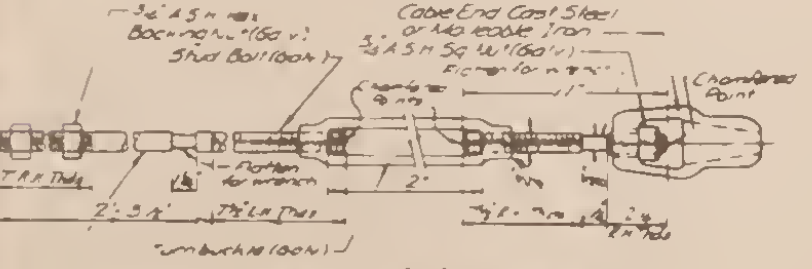
8. At all locations where the cable is connected to a cable socket with a wedge type connection, one wire of the wire rope shall be crimped over the base of the wedge to hold it firmly in place.

State Highway Commission
Helena, Montana
CABLE GUARD RAIL
No Scale

		STANDARD DRAWING 90-08	
Revised	12-10-68	APPROVED <i>[Signature]</i> 9-22-69	
Effective	1-1-69	State Highway Engineer	



DRIVEWAY ANCHOR SECTION



- GENERAL NOTES:**
1. At Driveways - use end anchor (See details, this sheet) use wood guide posts at driveway end anchorages only.
 2. End anchor posts for driveways shall be 6 WF Beams @ 15.50/ft.
 3. At all locations where the cable is connected to a cable socket with a wedge type connection, one wire of the wire rope shall be crimped into the base of the wedge to hold it firmly in place.
 4. See additional notes on Std Sheet 90-06

State Highway Commission
Helena, Montana
CABLE GUARD RAIL
DRIVEWAY ANCHOR SECTION
No Scale

Revised		Effective		Standard Drawing 90-07	
12-10-68		1-1-69		APPROVED	
				State Highway Engineer	

REVISED 5-1-64 11-1-68 9-17-69
EFFECTIVE 5-1-64 1-1-69 1-1-70

STANDARD DRAWING NO. 96-01

State Highway Commission
Helena, Montana

MONUMENTS & MARKERS

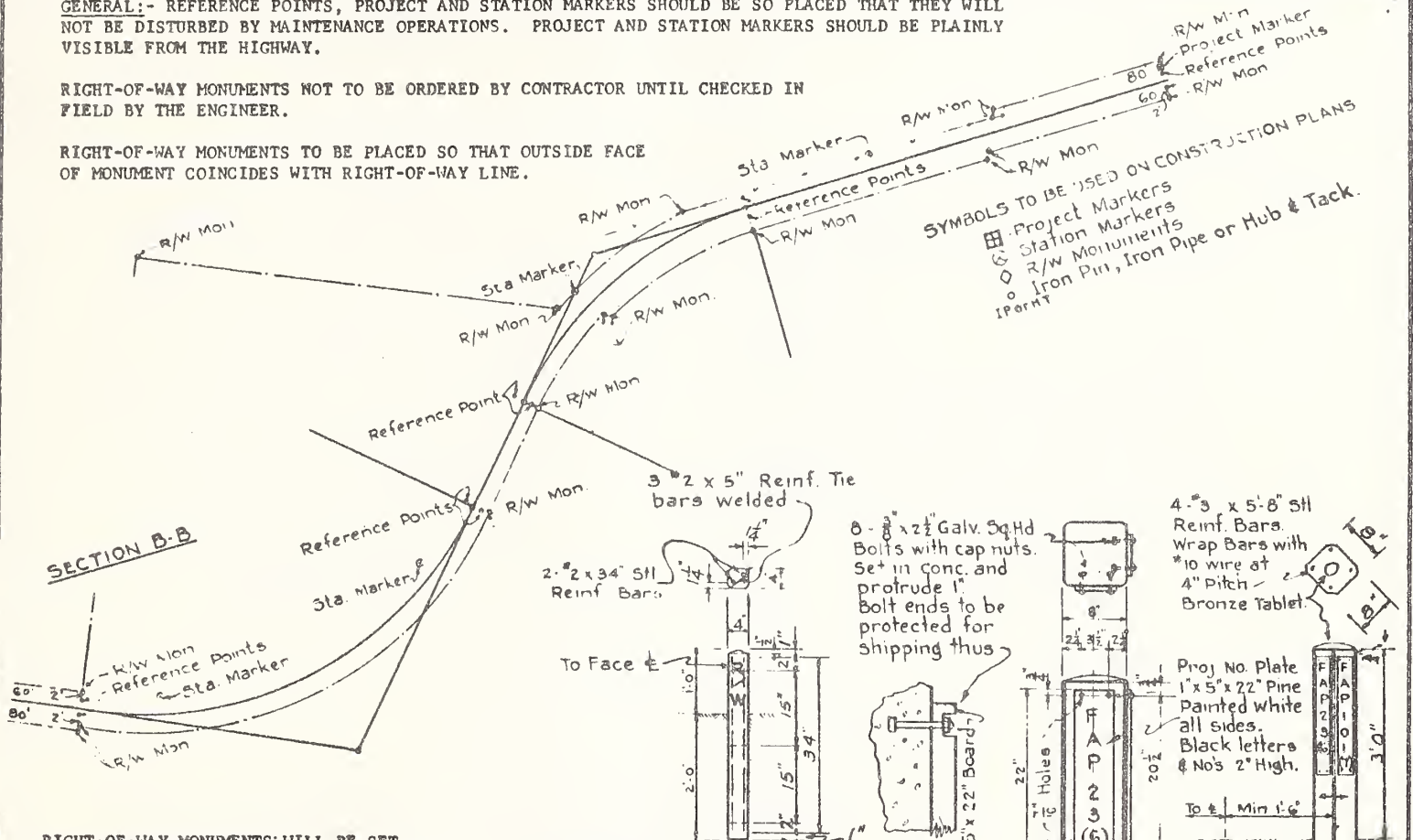
Approved

James M. Phillips 10-29-68
State Highway Engineer

GENERAL:- REFERENCE POINTS, PROJECT AND STATION MARKERS SHOULD BE SO PLACED THAT THEY WILL NOT BE DISTURBED BY MAINTENANCE OPERATIONS. PROJECT AND STATION MARKERS SHOULD BE PLAINLY VISIBLE FROM THE HIGHWAY.

RIGHT-OF-WAY MONUMENTS NOT TO BE ORDERED BY CONTRACTOR UNTIL CHECKED IN FIELD BY THE ENGINEER.

RIGHT-OF-WAY MONUMENTS TO BE PLACED SO THAT OUTSIDE FACE OF MONUMENT COINCIDES WITH RIGHT-OF-WAY LINE.



RIGHT-OF-WAY MONUMENTS WILL BE SET AT ALL POINTS WHERE THE WIDTH OF THE RIGHT-OF-WAY CHANGES, AND AT ANGLE POINTS, THE P.C. AND P.T. OF SIMPLE CURVES, AND THE T.S. AND S.T. OF SPIRAL CURVES. WHEN IT SEEMS UNDESIRABLE TO USE THE CONCRETE MONUMENTS, AS ON LOT OR BLOCK LINES IN SOME PARTS OF A TOWN, CONCRETE MONUMENTS WILL BE OMITTED AND IRON PIPES OR PINS WILL BE PLACED BY STATE HIGHWAY COMMISSION FORCES.

RIGHT-OF-WAY MONUMENT

CONCRETE:
RUBBED FINISH ON FACE. 4"x4" SQUARE.
RECESSED LETTERS 3" HIGH;
CORNERS CHAMFERED 1/2".

3" x 5" Reinf. Tie bars welded

2-2 x 34" Stl. Reinf. Bars

0-8" x 22" Galv. Sq Hd Bolts with cap nuts. Set in conc. and protrude 1" Bolt ends to be protected for shipping thus

5 x 22" Board

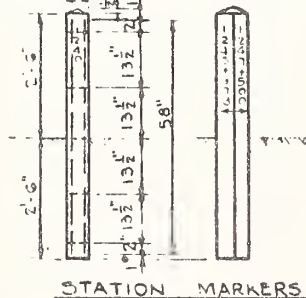
22" Holes

2-9"

3'-0"

Proj No. Plate 1' x 5' x 22" Pine Painted White all sides. Black letters & No's 2" High.

To & Min 1'-6"

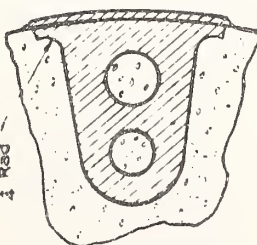
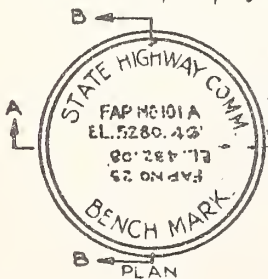


STATION MARKERS ARE TO BE SET OPPOSITE EVERY TENTH STATION AND AT IMPORTANT EQUATIONS. EQUATIONS OF LESS THAN 100' MAY BE DISREGARDED. MARKERS ARE TO BE SET ON THE NORTH OR WEST SIDE OF THE CENTERLINE DEPENDING ON THE GENERAL DIRECTION OF THE ROUTE OR SHALL BE SET SO AS TO BE VISIBLE FROM THE HIGHWAY CENTERLINE (ON R/W LINE IF POSSIBLE).

CONCRETE:
RUBBED FINISH ON FACE.
RECESSED LETTERS 3" HIGH EXCEPT EQUATIONS WHICH WILL BE 1 1/2" HIGH.
CORNERS CHAMFERED 1/2".

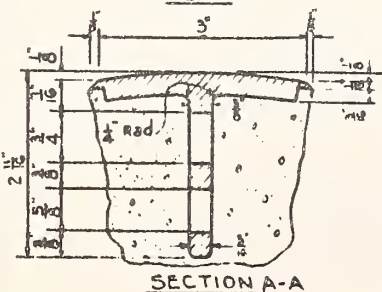
BRONZE TABLET

To be set in top of project marker



EXPOSED SURFACES OF THE TABLET ARE TO BE GROUND SMOOTH. LETTERS ARE TO BE RECESSED 1/16". INFORMATION ON THE TABLET, INDICATED BY PIN LINES, IS TO BE STAMPED IN THE FIELD BY THE ENGINEERING PARTY AFTER POST IS PLACED, USING 3/16" LETTERS.

BRONZE TABLET



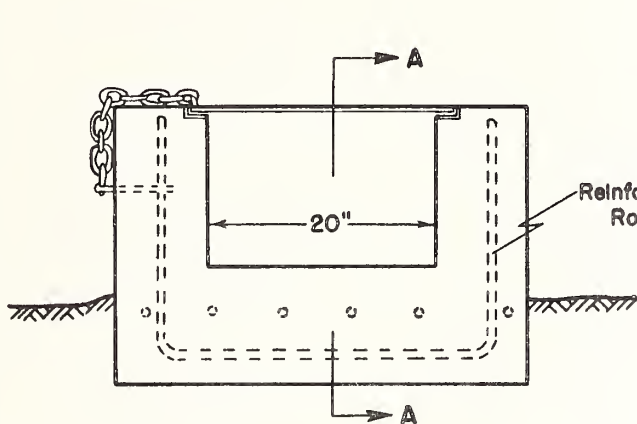
REVISED 8-1-65 11-1-68
EFFECTIVE 8-1-65 1-1-69

STANDARD DRAWING NO. 100-01

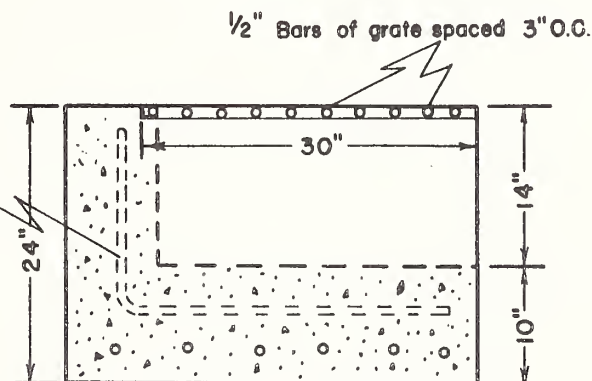
State Highway Commission
Helena, Montana

OUTDOOR FIREPLACE

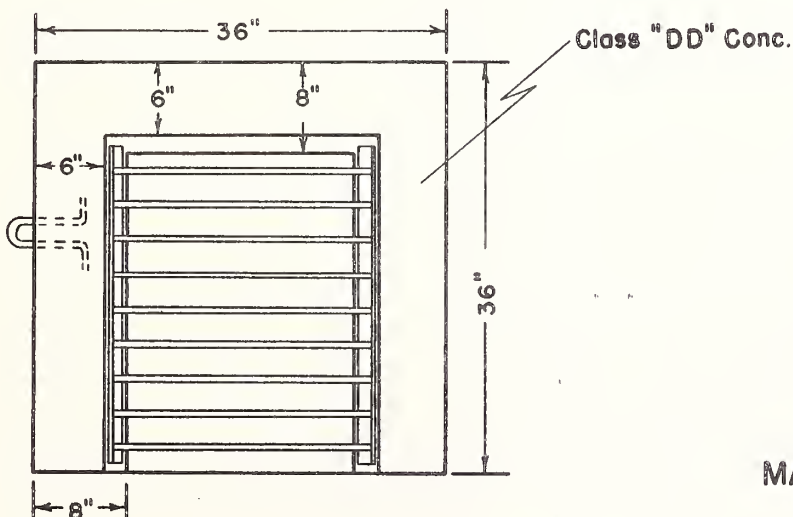
Approved
John H. Chittick 10-24-68
State Highway Engineer



FRONT VIEW



SECTION A-A

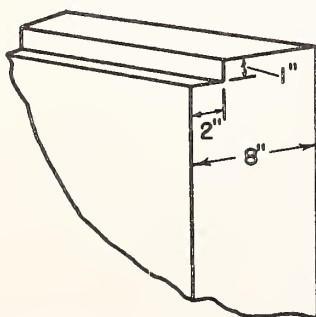


GRATE END VIEW

MATERIALS:

- 1/2 Cubic yard Class DD Conc.
- 88 ft. of Reinforcing Rod (1/2)
- 2 ft. length of chain (1/4)
- 2-29 Pcs. of 1/4" Angle Iron

CONCRETE:
CLASS "DD" OR EQUAL



DETAIL OF GRATE
LEDGE

REVISED 8-1-65 11-22-68
EFFECTIVE 8-1-65 1-1-69

STANDARD DRAWING NO. 100-02

State Highway Commission
Helena, Montana

GRATE DETAILS FOR CONCRETE FIREPLACE

Approved

Leona M. Shetter 10-24-68
State Highway Engineer

LIST OF MATERIALS

NO	SIZE	ITEM
13	3/4" X 3/4" X 1'-4" Bar	Top
4	1 1/4" X 1 1/4" X 1/4" X 1'-6" L	Corner Upright
2	1 1/4" X 1 1/4" X 1/4" X 2'-0" L	Top Edge
2	1 1/4" X 1 1/4" X 1/4" X 2'-2" L	Base
2	3/4" X 3/4" X 2'-0" Bar	Spacer

~ NOTE ~

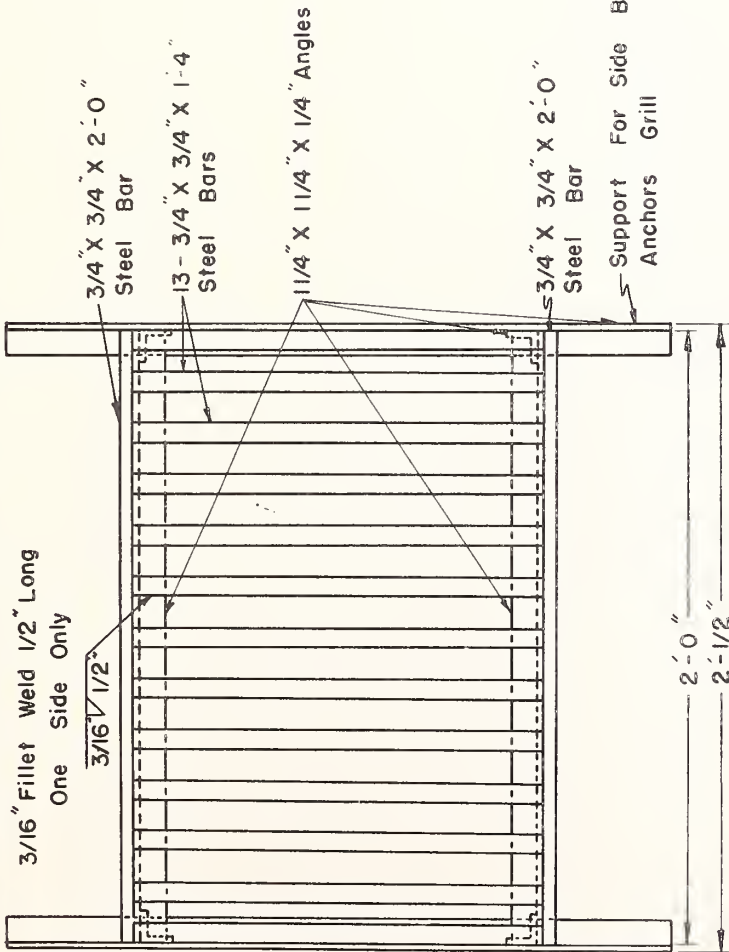
Fireplace Grate For Use With 3 Block Fireplace Only

Specifications:

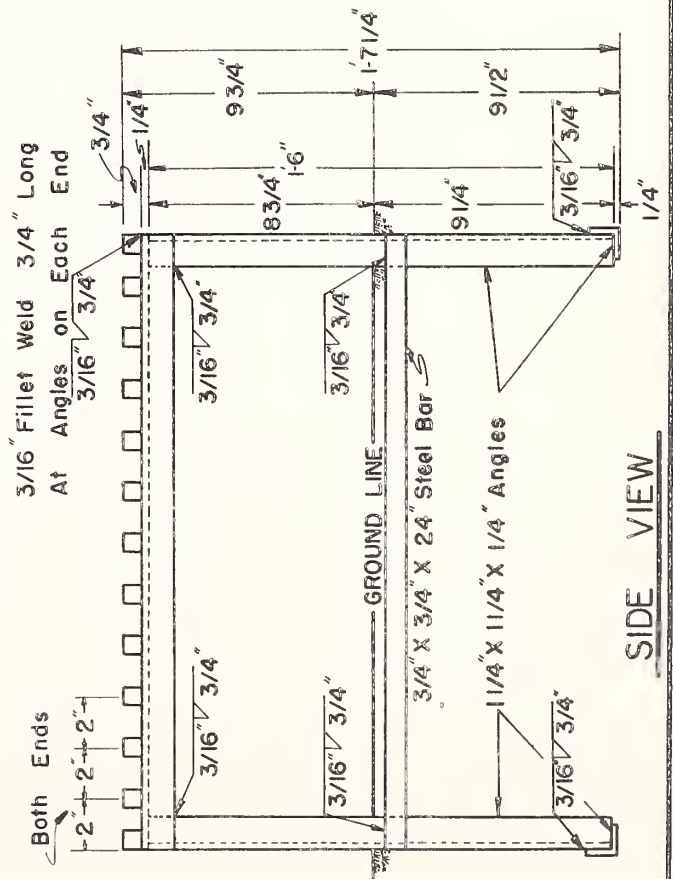
Structural Steel A.I.S.I. M-1020

Welding To Be Done In A Workmanlike Manner

Weight Of Grate = 66 Lbs. Approx.



PLAN



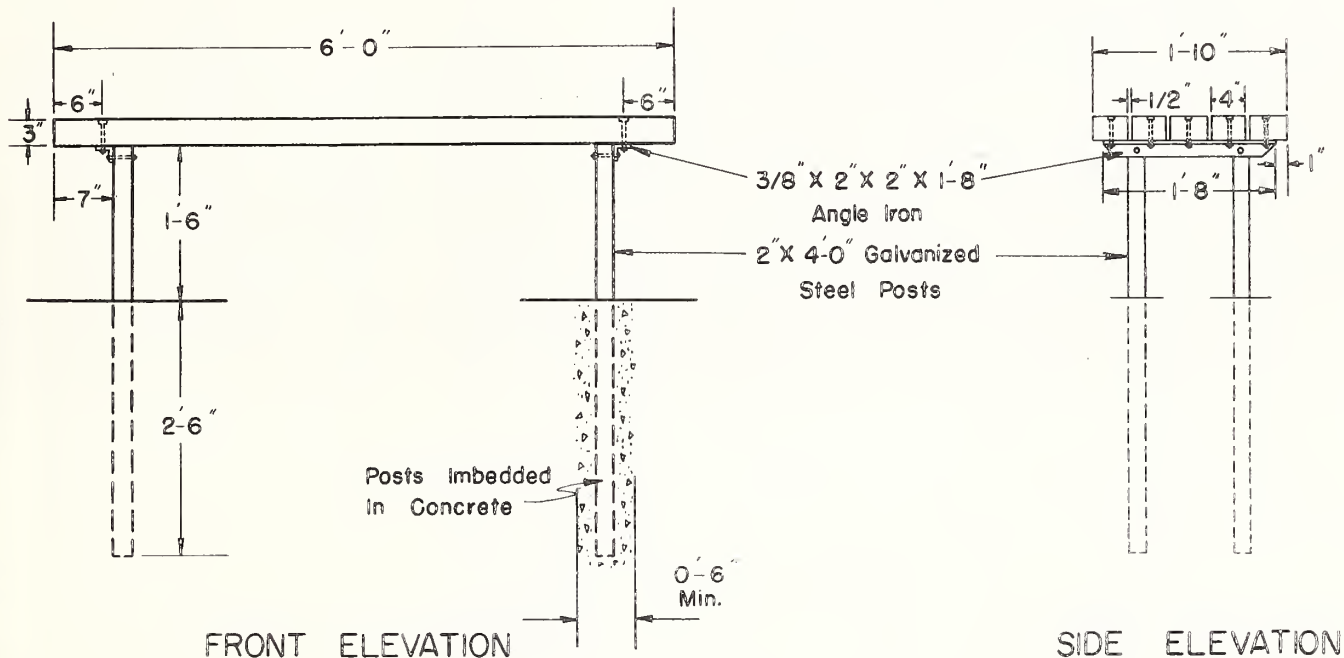
REVISED 8-1-65 11-1-68
EFFECTIVE 8-1-65 1-1-69

STANDARD DRAWING NO. 100-03

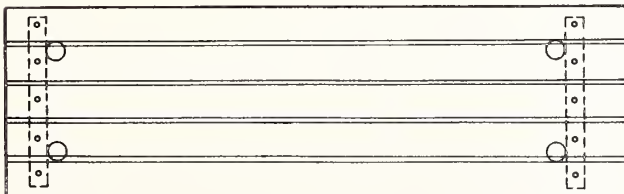
State Highway Commission
Helena, Montana

BENCH

Approved
Lewis R. Patton 12-24-68
State Highway Engineer



MATERIAL LIST		
NO.	SIZE	REMARKS
2	3/8" X 2" X 2" X 1'-8"	Angle Iron
5	3" X 4" X 6'	Boards
4	2" X 4"	Galvanized Steel Posts
4	1/2" X 3"	Machine Bolts
10	3/8" X 4"	Machine Bolts
1 Cu. Ft.		Class "DD" Concrete



PLAN VIEW

CONCRETE:
CLASS "DD" OR EQUAL

REVISED 8-1-65 11-1-68
EFFECTIVE 8-1-65 1-1-69

STANDARD DRAWING NO. 100-04

State Highway Commission
Helena, Montana

PARK BENCH

Approved
Louis H. Dettiger 10-24-68
State Highway Engineer

MATERIAL LIST			
UNIT	NO	SIZE	DESCRIPTION
LIN. FT.	14	4 X 6 X 7	WOOD CONST. GRADE P & T PENTHACHLOROPHENAL TREATED
LIN. FT.	6	2 X 10	CONST. GRADE J & P
LIN. FT.	6	2 X 12	CONST. GRADE J & P
LIN. FT.	3	3 X 6 X 16	CONST. GRADE J & P
EACH	12	3/8 X 6	CARRIAGE BOLTS
CU. YD.	1/8		CLASS "DD" CONC. AROUND POSTS

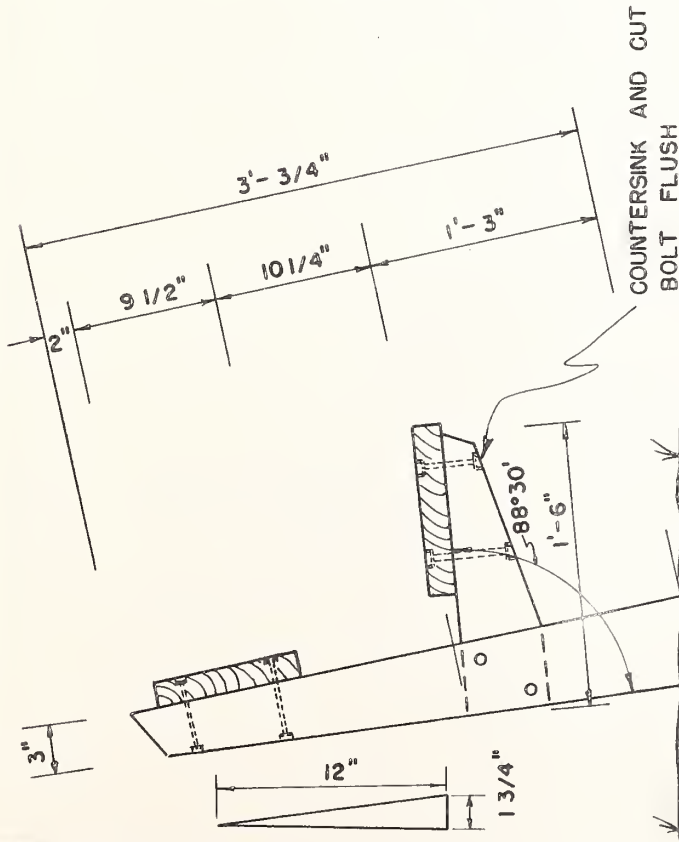
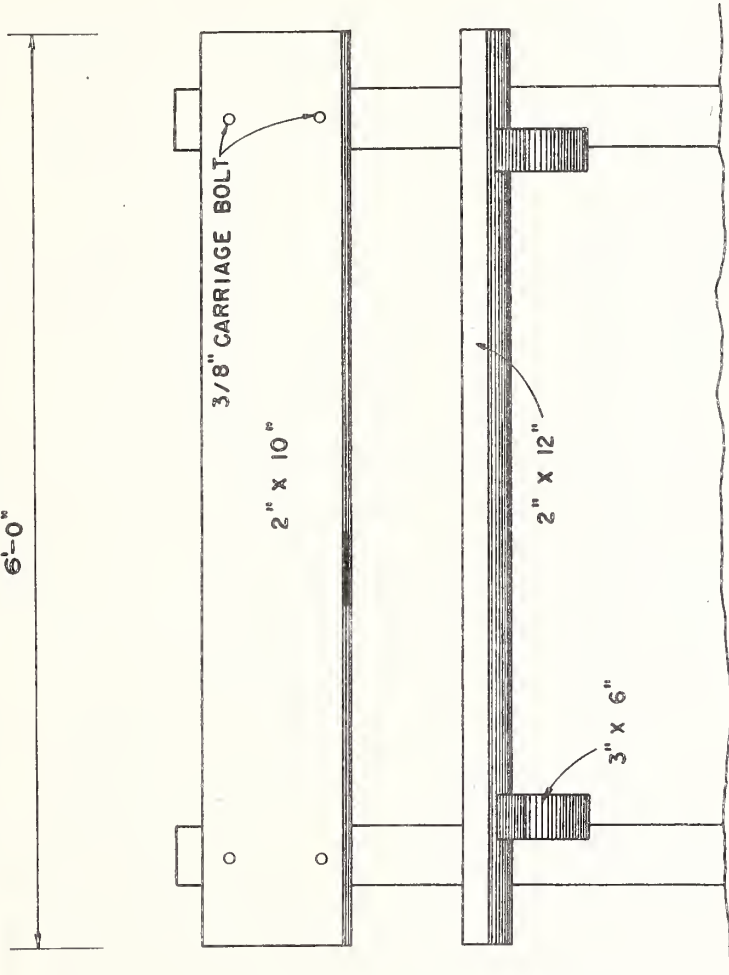
CONCRETE:
CLASS "DD" OR EQUAL

SIDE ELEVATION

A SIMPLE, INEXPENSIVE AND EASILY
FABRICATED PARK BENCH INTENDED
FOR PERMANENT PLACEMENT. ALTHO
THIS PARTICULAR PLAN SHOWS
LUMBER CONSTRUCTION, THE UPRIGHTS
MAY BE MADE OF PRECAST REINFORCED
CONCRETE.



SCALE



END ELEVATION

TIMBER PICNIC TABLE

Approved

Lewis M. Chittum 10-24-68
State Highway Engineer

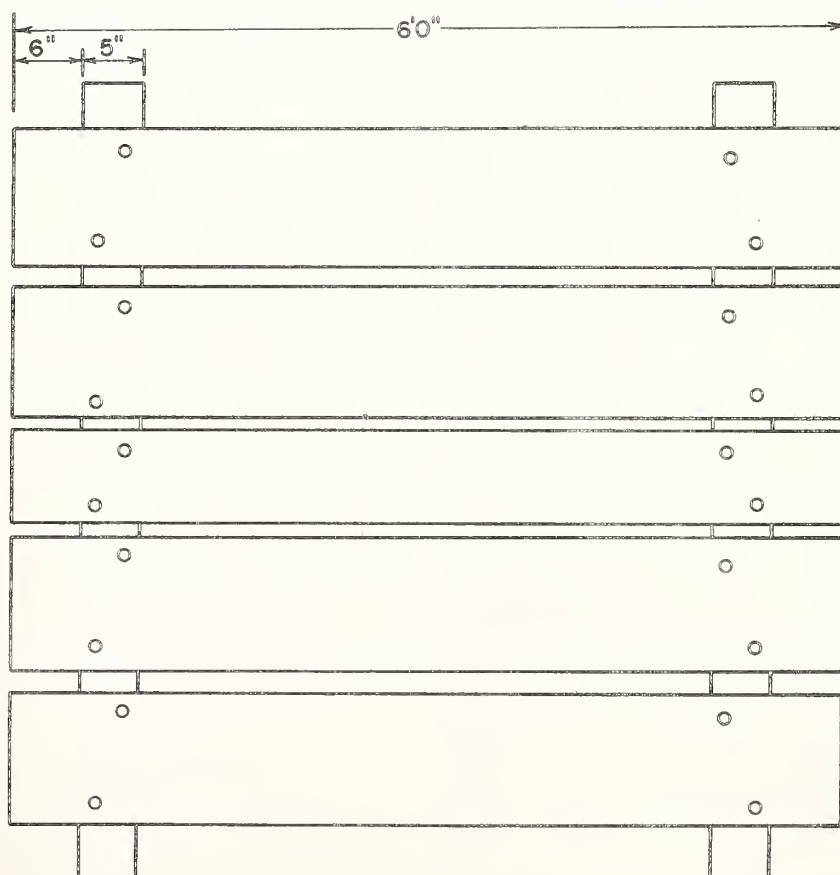


NOTE
Fill all
wood

An all wood Picnic Table suited for areas of heavy use. This table is most economical to build in those regions where lumber of such proportions may be obtained relatively inexpensively.

MATERIAL LIST				DESCRIPTION
UNIT	NO.	SIZE		
Cu. Yd.	1/8			Class "DD" Concrete
Lin. Ft.	12	3" X 12"		Wood Plank Treated Fir, Pine & Larch Only
Lin. Ft.	6	3" X 10"		Wood Plank Treated Fir, Pine & Larch Only
Each	2	5" X 13" X 5'-10"		Timber Fir, Pine & Larch Only
Each	2	5" X 10" X 2'-8"		Timber Fir, Pine & Larch Only
Each	1	4" X 4" X 6'-0"		Timber Fir, Pine & Larch Only
Each	8	1/2" X 9"		Lag Screws
Each	20	3/8" X 6"		Lag Screws
Lin. Ft.	12-	4" X 12"		Wood Plank Treated

CONCRETE



TOP

REVISED 8-1-65 11-1-68
EFFECTIVE 8-1-65 1-1-69

STANDARD DRAWING NO. 100-06

State Highway Commission
Helena, Montana

STONE PICNIC TABLE

Approved
10-24-68
State Highway Engineer

NOTE

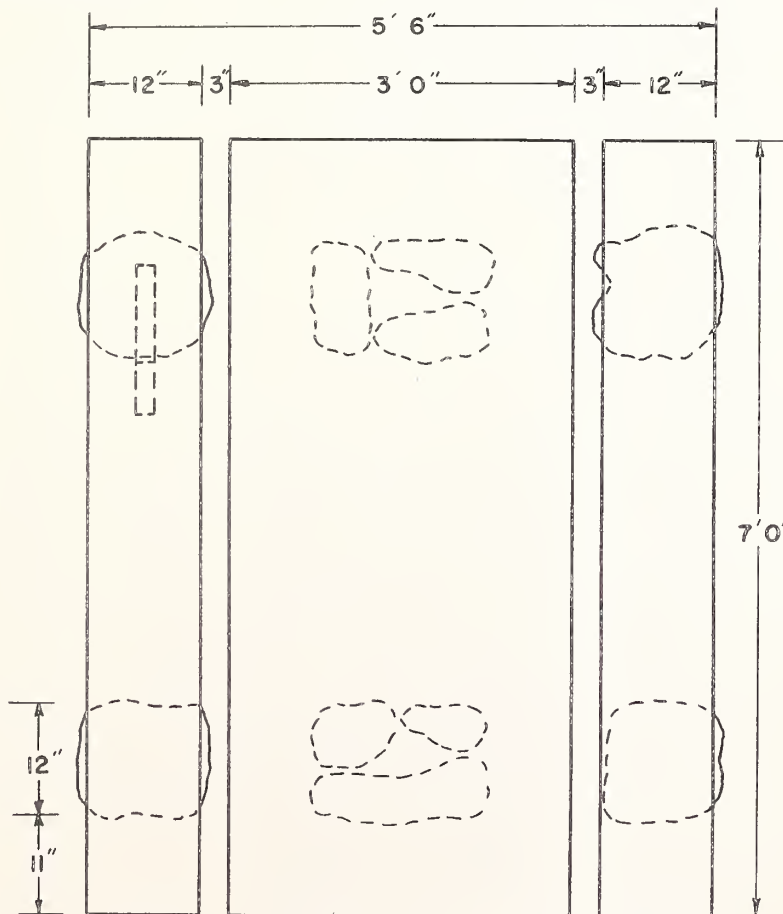
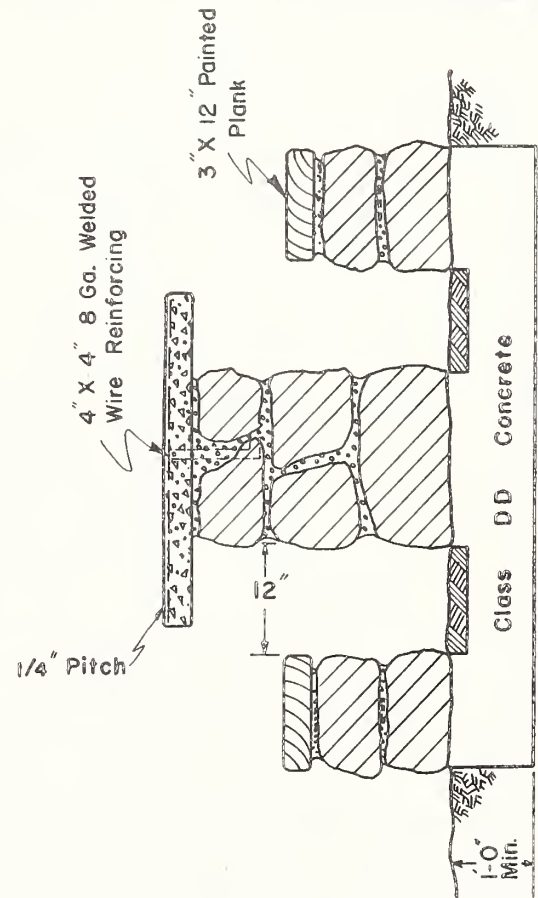
The Table Top is Of Pre cast Concrete And The Uprights Are Of Field Stone.



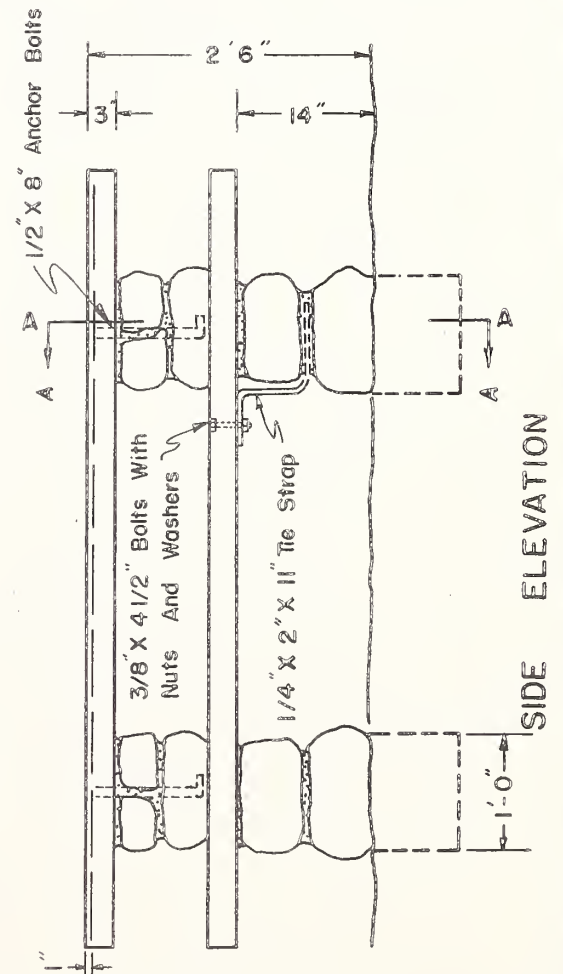
MATERIAL LIST

UNIT	NO.	SIZE	DESCRIPTION
Lin. Ft.	14	3" X 12'	Wood Plank
Cu. Yds.	1/8		Table Top Pre Cast "DD"
Sq. Ft.	21	4" X 4" X 8 Ga.	Welded Wire Mesh
Cu. Yds.	1/2		Class "DD" Conc
Sq. Ft.	40		Masonry Surface
Each	2	1/2" X 8"	Anchor Bolts
Each	4	3/8" X 2" X 11"	Straps
Each	4	3/8" X 4 1/2"	Bolts With Washers

CONCRETE:
CLASS "DD" OR EQUAL



PLAN VIEW



SIDE ELEVATION

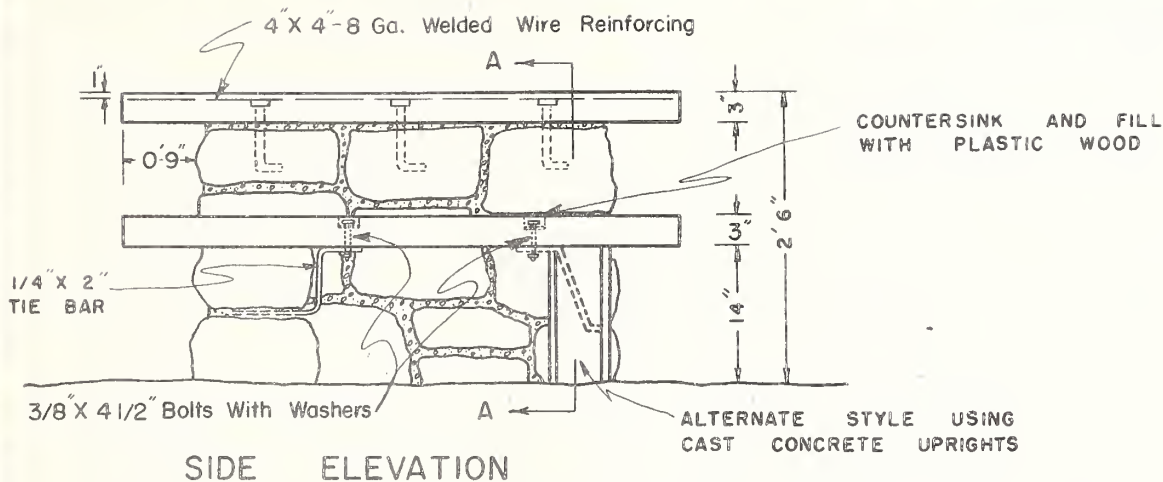
REVISED 8-1-65 11-1-68
EFFECTIVE 8-1-65 1-1-69

STANDARD DRAWING NO. 100-07

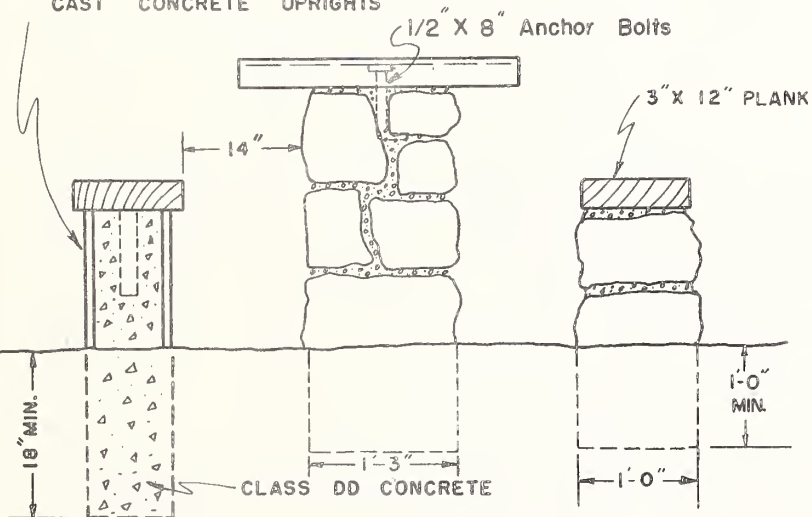
State Highway Commission
Helena, Montana

STONE PICNIC TABLE

Approved
Lucas H. Hulbert 10-24-68
State Highway Engineer



ALTERNATE STYLE USING
CAST CONCRETE UPRIGHTS



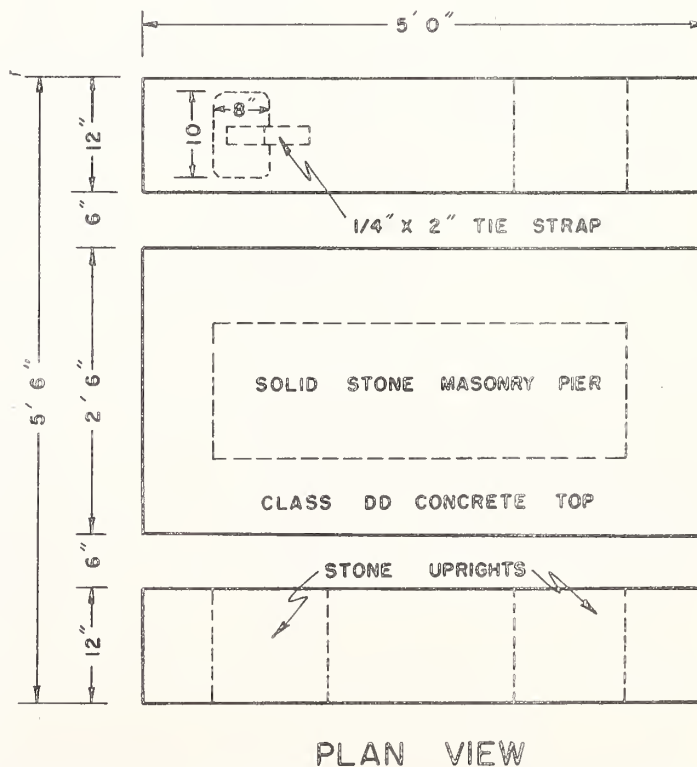
NOTE :

THE TABLE TOP IS PRE CAST CONCRETE, THE BENCH SUPPORTS ARE EITHER FIELD STONE OR CAST CONCRETE AND THE TABLE SUPPORT IS OF FIELD STONE AND MASONRY. THE SEATS ARE TREATED PLANKS (OAK IF AVAILABLE.)

MATERIAL LIST

UNIT	NO.	SIZE	DESCRIPTION
Cu. Yds.	1/8		Table Top Concrete "DD"
Sq. Ft.	12 1/2	4" X 4" X 8 Ga.	Welded Steel Mesh
Lin. Ft.	7	1/4" X 2"	Scrap Iron
Lin. Ft.	10	3" X 12"	Oak Plank (Treated)
Sq. Ft.	38		Masonry Surface
Each	3	1/2" X 8"	Anchor Bolts
Cu. Yd.	1/3		Class "DD"

CONCRETE: CLASS "DD" OR EQUAL



REVISED 3-1-66 11-1-68
EFFECTIVE 3-1-66 1-1-69

STANDARD DRAWING NO. 100-08

State Highway Commission
Helena, Montana

TWO TABLE PICNIC SHELTER

Approved
James O. H. Hutton, 10-24-68
State Highway Engineer

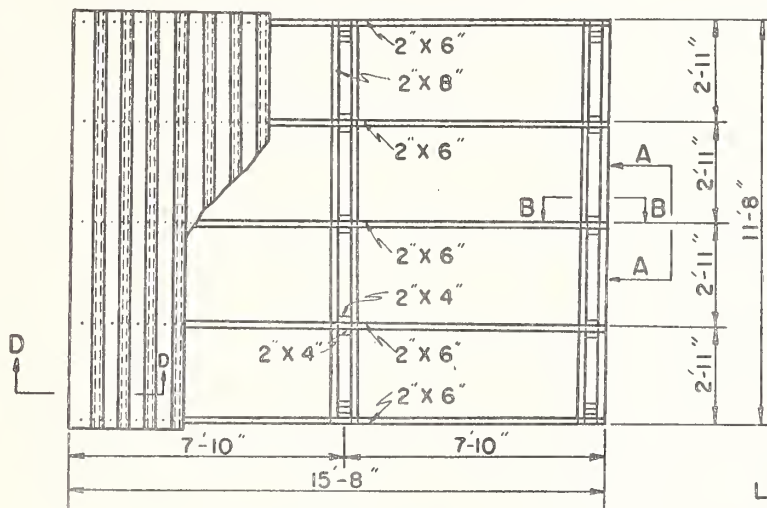
CONCRETE: CLASS "DD" OR EQUAL

MATERIAL LIST

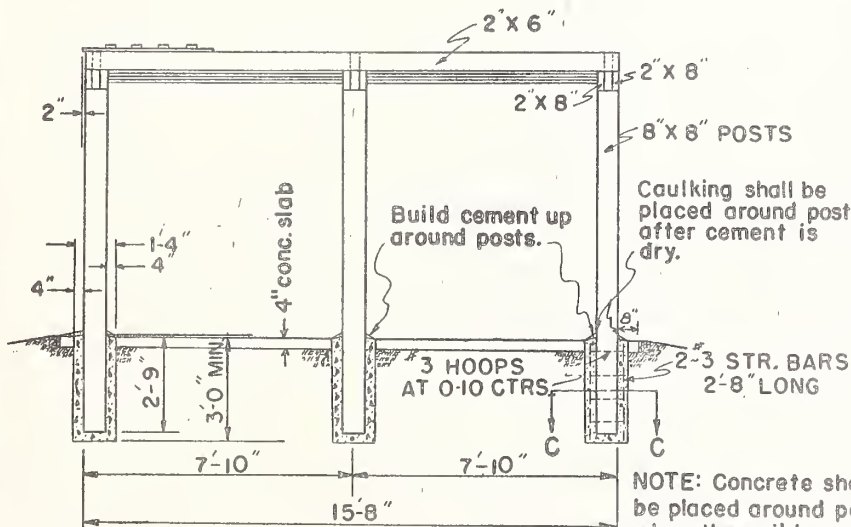
NO	SIZE	COMMERICAL LENGTH	REQUIRED LENGTH	DESCRIPTION
19	1"X4"	12'-0"	12'-0"	LUMBER ROOFING
20	1"X8"	12'-0"	12'-0"	
5	2"X6"	16'-0"	15'-8"	RAFTERS
6	2"X8"	12'-0"	11'-8"	BUILT UP BEAM
2	2"X4"	14'-0"	(24) 1'-2"	
1	2"X4"	12'-0"	(18) 0'-8"	
6	8"X8"	10'-0"	(3) 10'-3" (3) 9'-6"	POSTS
24	#3		4'-8"	REINFORCING STEEL
24	#3		2'-8"	
12	3/16"X0-7 1/2"		0'-3"	STEEL SPLICE PLATES
12	1/2"X0-3"		0'-3"	LAG SCREWS
1	YD 3			CL. DD CONCRETE
6	LB'S.			16 d NAILS
4	LB'S.			16 d BOX NAILS
72	1/2" Ø			LOCK WASHERS
* 24.6 SQ. YDS. 4" X 13' X 17' CONC. SLAB				

NOTE:

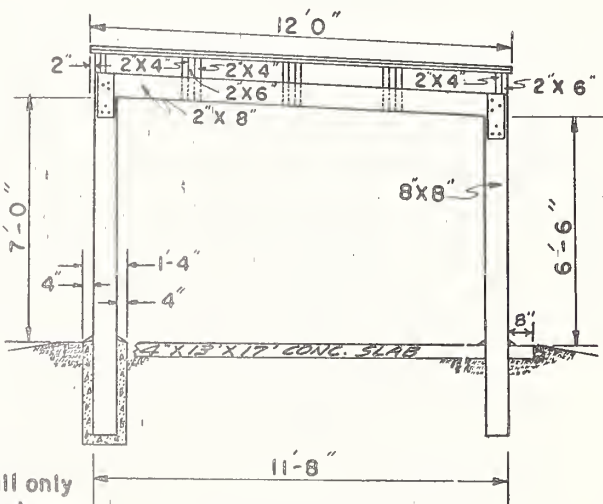
LUMBER ÷ ALL LUMBER SHALL BE COMMERCIAL GRADE NO. 3 OR BETTER.
TREATMENT OF POSTS ÷ THE LOWER 3 1/2 FT. OF THE 8"X8" POSTS SHALL BE DIPPED IN A 5% SOLUTION OF PENTACHLOROPHENOL FOR AT LEAST 12 CONTINUOUS HOURS.



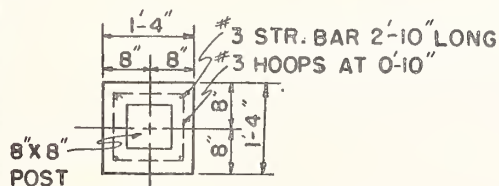
PLAN VIEW



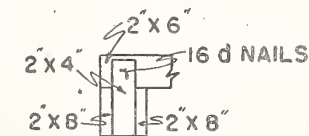
FRONT VIEW



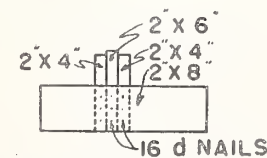
SIDE VIEW



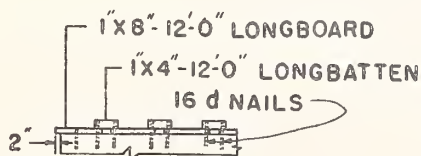
SECTION C-C



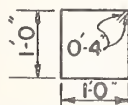
SECTION B-B



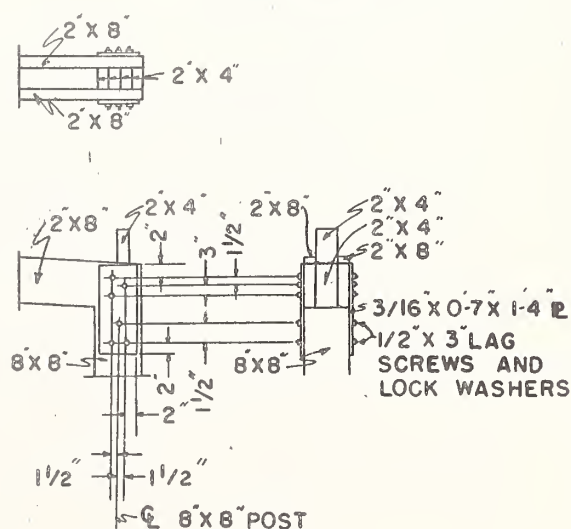
SECTION A-A



SECTION D-D



BENDING DIAGRAM



CORNER DETAILS

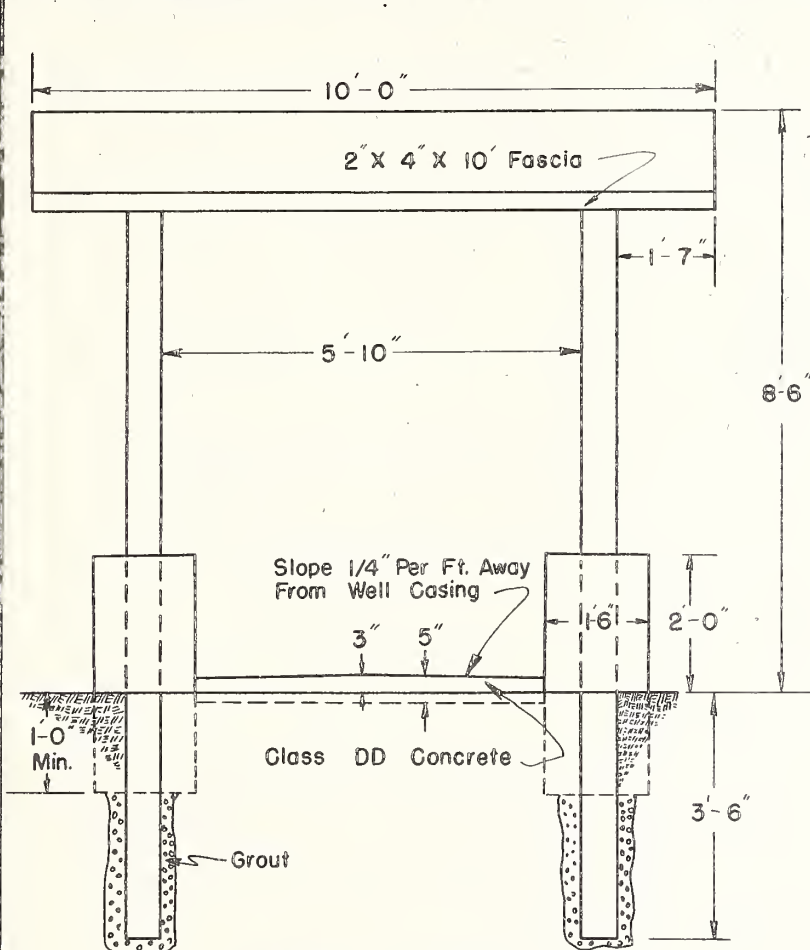
REVISED 8-1-65 11-1-68
EFFECTIVE 8-1-65 1-1-69

STANDARD DRAWING NO. 100-09

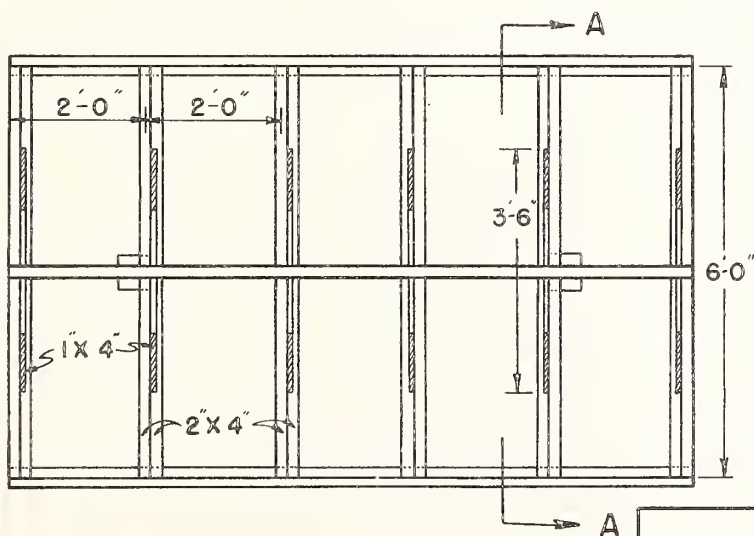
State Highway Commission
Helena, Montana

WELL SHELTER

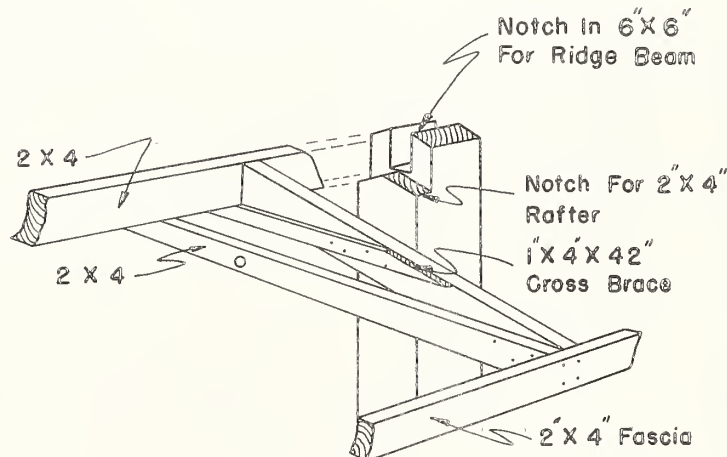
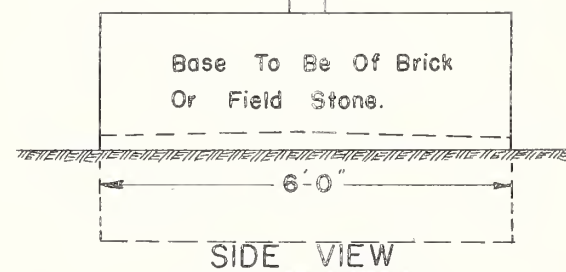
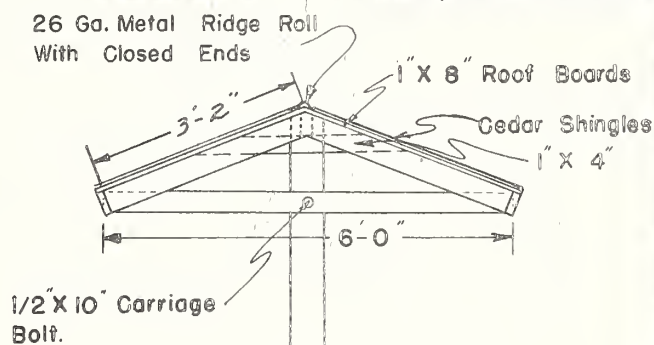
Approved
Lewis H. Dilling 10-24-68
State Highway Engineer



FRONT VIEW



PLAN VIEW



SECTION A-A
(PERSPECTIVE DETAIL)

MATERIAL LIST

UNIT	NO.	SIZE	DESCRIPTION
Sq. Ft.	65	16"	#1 Cedar Shingles
Bd. Ft.	70	1" X 8"	#3 Common Boards, Pine
Bd. Ft.	70	2" X 4"	#2 & Better Fir & Larch
Bd. Ft.	8	1" X 4"	#2 Common Board, Pine
Lin. Ft.	24	6" X 6" X 12'	Const. Grade P & T
Lin. Ft.	10	26 Ga.	Ridge Roll With Ends
Each	2	1/2" X 10"	Carriage Bolt With Nut & Washer
Cu. Yd.	1		Class "DD" Concrete
Sq. Ft.	60		Masonry Surface

CONCRETE: CLASS "DD" OR EQUAL

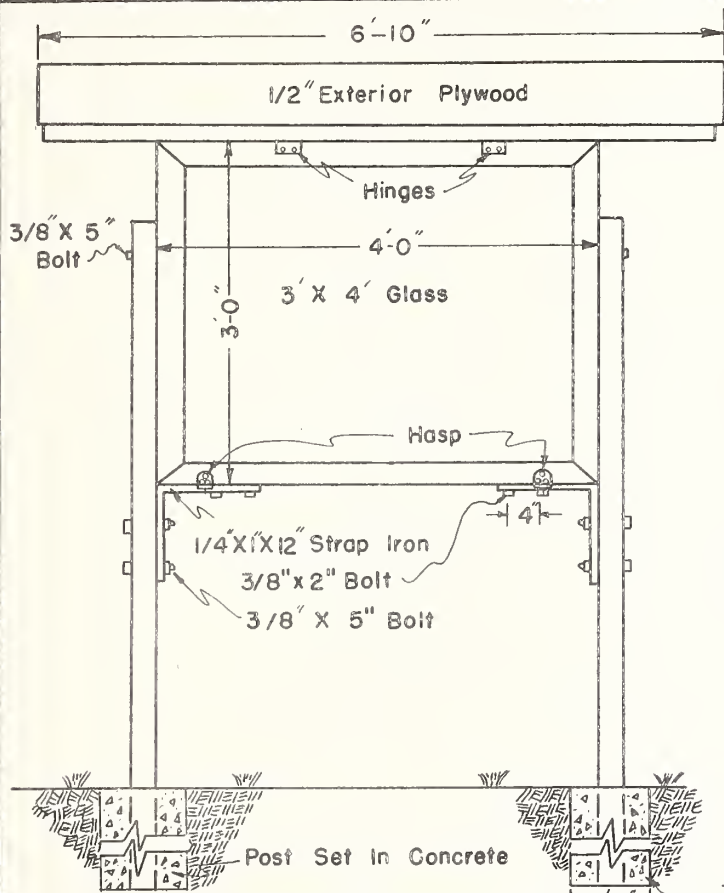
REVISED 8-1-65 11-1-68
EFFECTIVE 8-1-65 1-1-69

STANDARD DRAWING NO. 100-10

State Highway Commission
Helena, Montana

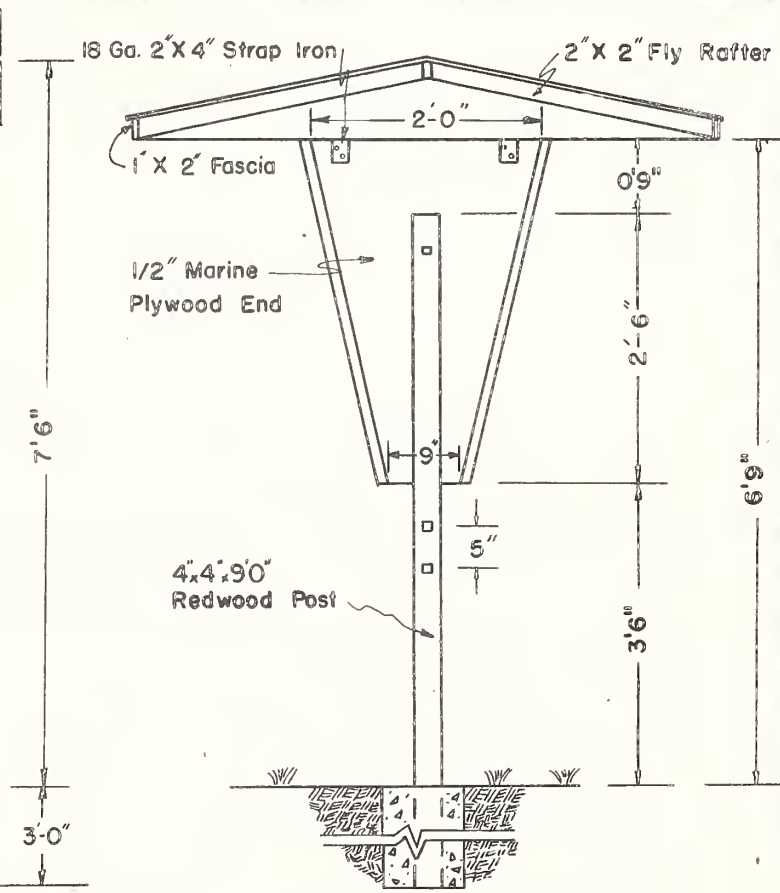
EXHIBIT CASE

Approved
J. H. Phillips 10-24-68
State Highway Engineer

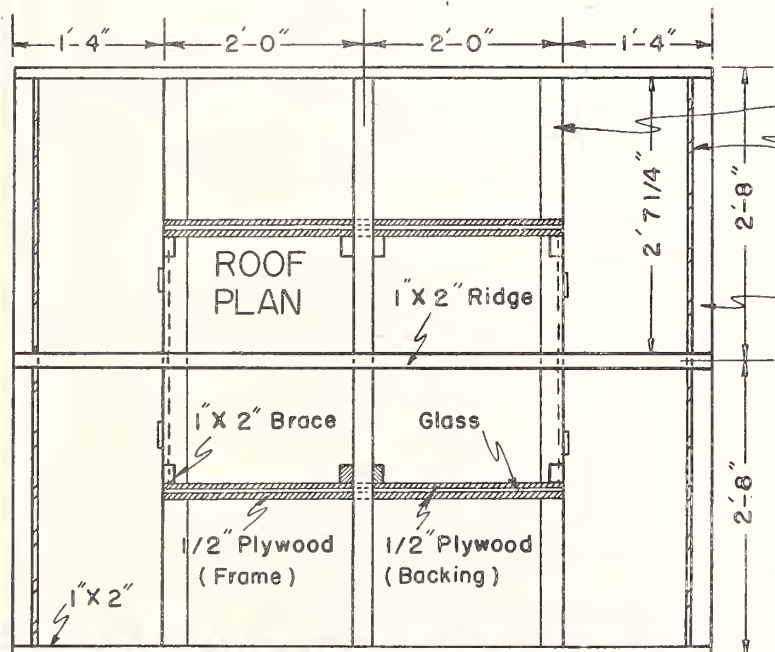


FRONT ELEVATION

CONCRETE: CLASS "DD" OR EQUAL

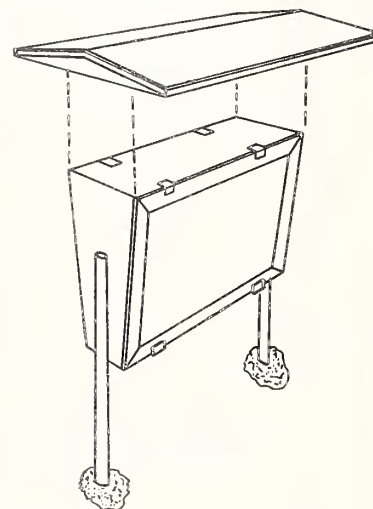


SIDE ELEVATION

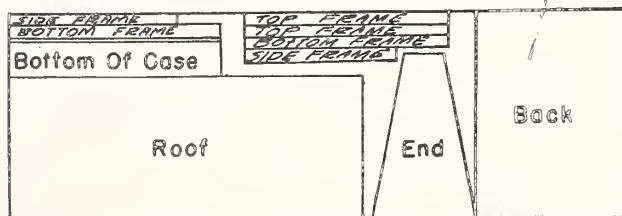
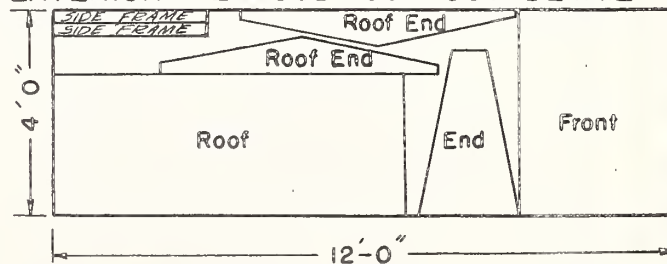


Rafter Cut From
2' x 10", 3 Required
Plywood Roof End

2' x 2" Fly Rafter



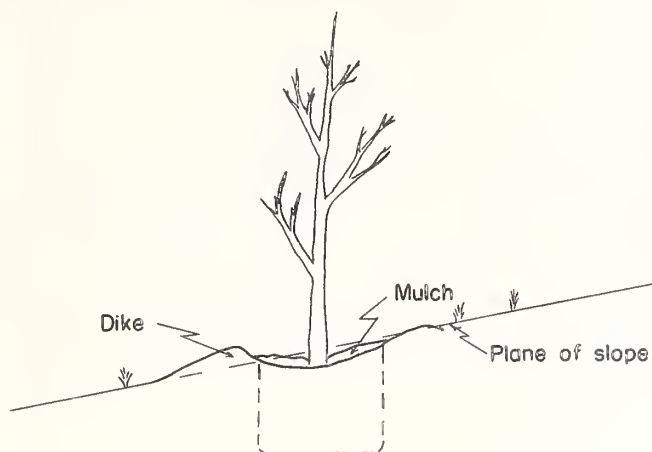
EXTERIOR PLYWOOD CUT OUT DETAIL



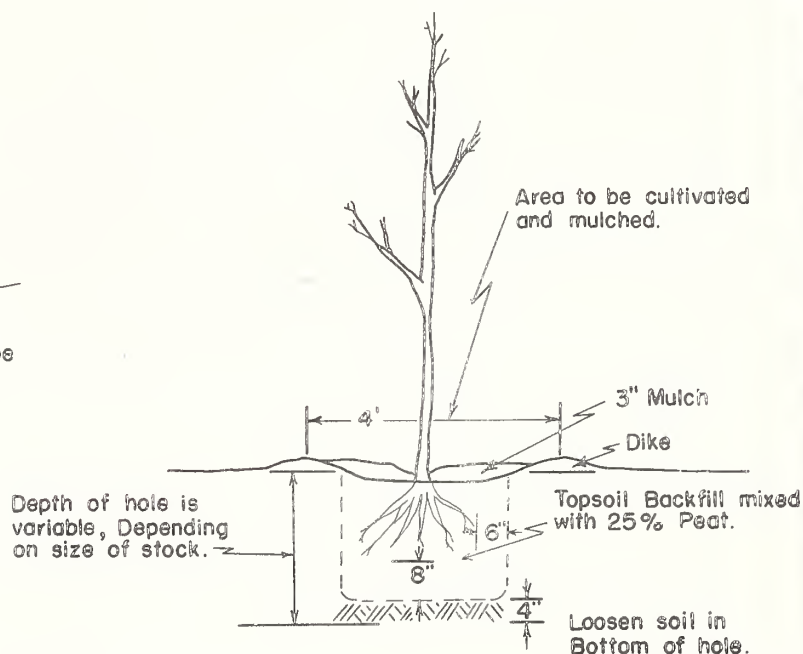
UNIT	NO.	SIZE	DESCRIPTION
SQ. FT.	100		1/2" EXTERIOR PLYWOOD
EACH	2	4' x 4' x 9'	REDWOOD POSTS
EACH	4	3/8" x 2"	BOLTS WITH NUTS AND WASHERS
EACH	6	3/8" x 5"	BOLTS WITH NUTS AND WASHERS
SQ. FT.	24	3' x 4'	DOUBLE STRENGTH GLASS
EACH	4		HINGES AND SCREWS
LIN. FT.	30	2' x 2"	#2 AND BETTER FIR AND LARCH
LIN. FT.	40	1' x 2"	#2 COMMON BOARD
LIN. FT.	2	1/4" x 1' x 12"	STRAP IRON
EACH	4		HASP
EACH	4	2' x 4'-18 GA.	METAL STRAPS, GALVANIZED

Top
Of
Case

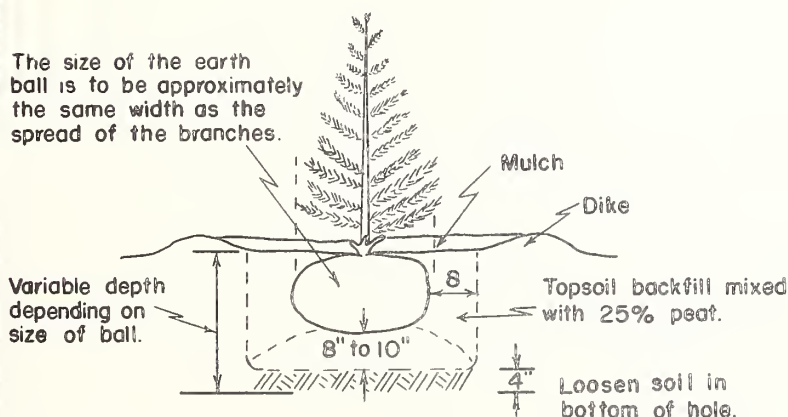
PLANTING & STAKING PROCEDURES



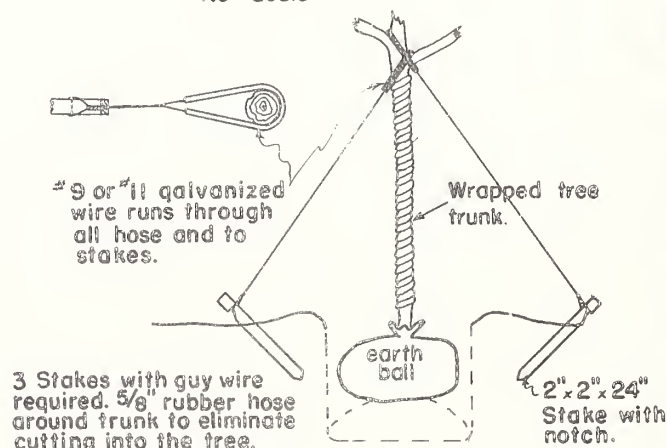
SLOPE PLANTING
No Scale



PLANTING DETAIL FOR BARE ROOT STOCK
No Scale



PLANTING DETAIL FOR BALL AND BURLAP CONIFERS
No Scale



BRACING WITH 3 GUY WIRES AND STAKES

NOTE:

Plants shall be watered thoroughly after plant holes are backfilled to allow for the best possible settling of soil in and around the roots. Applies for both bare root and B & B stock.

In extremely heavy clay soils, the backfill material is to be mixed with an additional 25% of sand as well as the 25% of peat. These components should be thoroughly mixed.

In areas of a lighter clay soil, sand may be mixed in a lesser per cent.

Only those trees of a height greater than five feet will require staking.

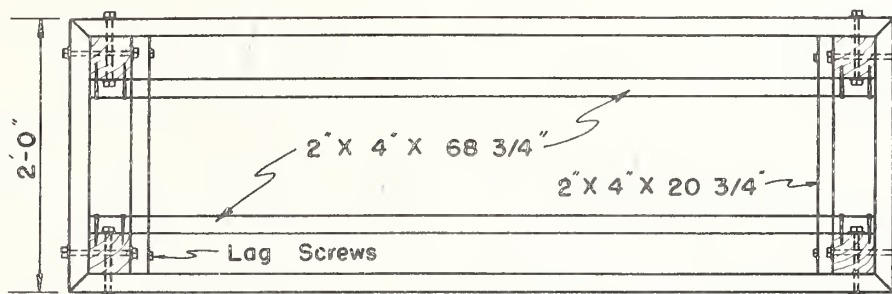
REVISED 5-1-66 11-22-68
EFFECTIVE 5-1-66 1-1-69

STANDARD DRAWING NO. 100-12

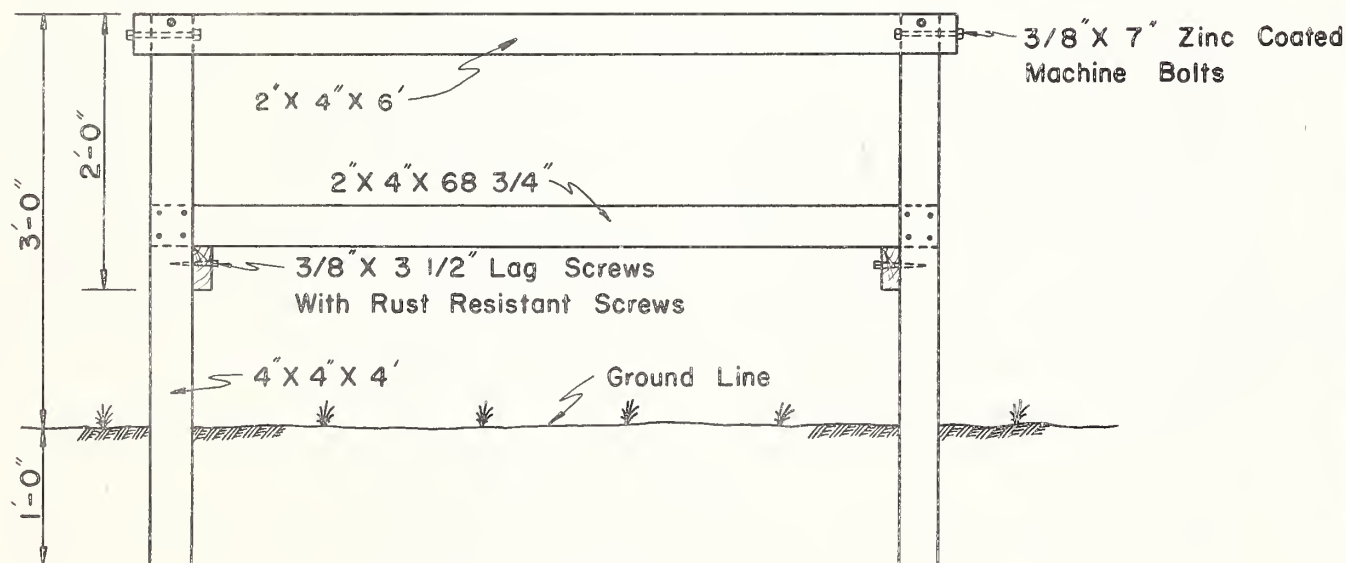
State Highway Commission
Helena, Montana

GARBAGE CAN RACK

Approved
Louis H. Christman 10-29-68
State Highway Engineer



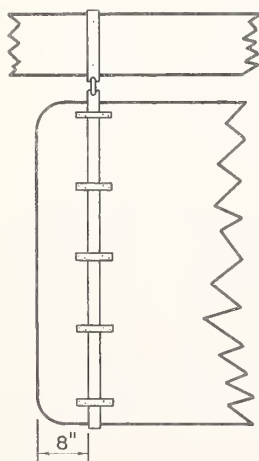
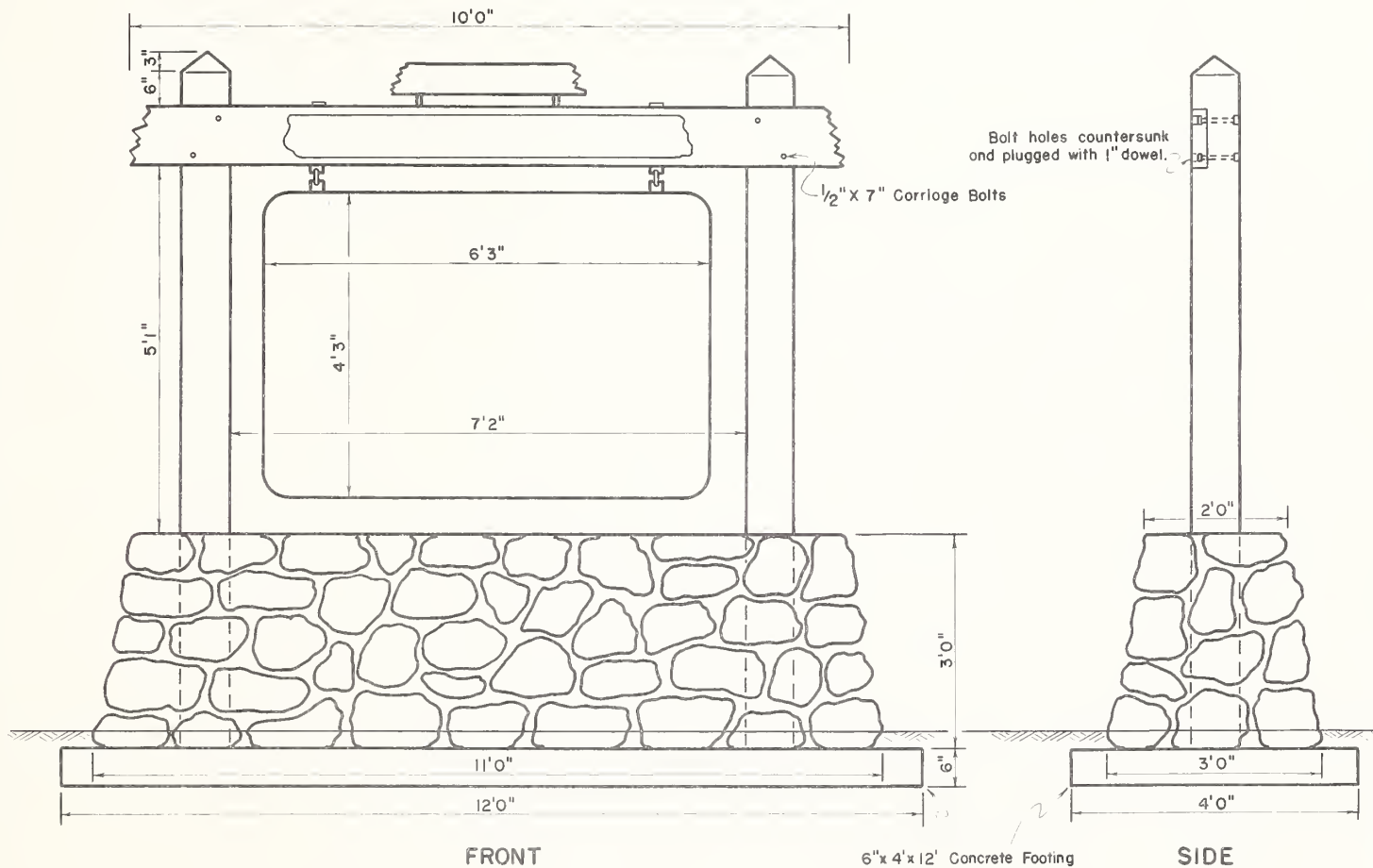
PLAN VIEW



SIDE VIEW

MATERIAL			
UNIT	NO.	SIZE	DESCRIPTION
Lin. Ft.	32	2"X4"X6'	Side Rail & Can Supports
Lin. Ft.	16	4"X4"X4'	Corner Support Posts
Each	8	3/8"X7"	Zinc Coated Machine Bolts
Each	4	3/8"X3 1/2"	Lag Screws Rust Resistant
Lbs.	1/2	16d Common	Galvanized Nails
Each	3	30 Gal. Min	Galvanized Garbage Cans
Each	1	Quart	Forest Green - Columbia No. 162 Or A Similar Color & Quality Paint By Another Co.

NOTE: All Lumber To Be Redwood Or Cedar.



Detail for attaching hanging irons to back of sign panel.

Sign panel 5/4" Redwood doweled and glued. Lettering routed and painted white. Posts 8"x8" structure. Fir headpiece 3"x10" structure. Fir silhouette design routed in headpiece panel, posts and headpiece treated with Linseed Oil and wiped.

Base to be constructed of stone common to adjacent area.

